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OISE's Magazine for Schools

VOL. 37, NO. 1, 2007

PROMISING PRACTICES IN SPECIAL EDUCATION

GUEST EDITORS:
Rhonda Martinussen
John Morgan
Rosemary Tannock

OISE
Ontario Institute for Studies in Education
University of Toronto

orbit

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VOLUME 37, NUMBER 1, 2007

Promising Practices in Special Education

Guest Editors:
Rhonda Martinussen
John Morgan
Rosemary Tannock

Orbit publishes theme issues on topics of concern and relevance for teachers and administrators working in schools and school systems, from junior kindergarten to the end of high school.

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PHOTO CREDITS

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p. 1: Photos by Jim Allen.

GUEST EDITORS

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Rhonda Martinussen is an assistant professor of Special Education and Adaptive Instruction in the Department of Human Development and Applied Psychology and the Institute of Child Study at OISE. Her research focuses on investigating cognitive and behavioural predictors of children's reading and writing achievement. Her particular interest is in the association between inattention and literacy skills. Rhonda is also interested in teachers' beliefs about attention-deficit/hyperactivity disorder (ADHD) and the types of instructional and behavioural management approaches that teachers use in the classroom to enhance academic success for students with ADHD. Her experience includes working in general education classrooms in the primary/junior grades and working as a research teacher in a study investigating different remediation approaches for students with co-existing ADHD and reading disorder. She was a member of the Ontario Ministry of Education's Expert Panel for *Education for All: The Report of the Expert Panel on Literacy and Numeracy Instruction for Students with Special Education Needs, Kindergarten to Grade 6.*

John Morgan (pp. 4, 14, 19, 43)

John Morgan has been a classroom teacher, a special educator, an educational researcher, and a university lecturer. He is currently a lecturer at the Institute of Child Study in the Department of Human Development and Applied Psychology at OISE. John's research and teaching interests include learning disabilities, mathematics disabilities, reading instruction, and second language learners.

Rosemary Tannock (pp. 4, 19, 32)

Rosemary Tannock, PhD, holds a Canada Research Chair in Special Education and Adaptive Technology at OISE, and is a senior scientist at The Hospital for Sick Children. Her research focuses on attention-deficit/hyperactivity disorder (ADHD) and is funded by the Canadian Institutes of Health Research, Canadian Council on Learning, Centre for Excellence in Child and Youth Mental Health, Canadian Language and Literacy Research Network, and TV Ontario. She and her colleagues developed a set of integrated multimedia resources on ADHD for teachers, including a web site (www.teachadhd.ca), DVD, and Teacher's Resource Manual. During the 2006/2007 academic year she gave invited workshops on ADHD to educators in Norway, Greece, Iceland, China, Singapore, and Australia.

CONTRIBUTORS

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EDITORIAL

Rhonda Martinussen, John Morgan, Rosemary Tannock

The Ontario Institute for Studies in Education (OISE) is currently reflecting upon and celebrating its 100 years of studies in education at the University of Toronto (1907–2007). It is timely, therefore, to also reflect on the roles that OISE and Canada have played in Special Education in terms of the education of students with students with special educational needs and the education and training of their teachers.

Ken Weber, now professor emeritus, University of Toronto, has noted that our current conception of "special education" is a late 20th century phenomenon. It was only in 1980 that the Ontario Government passed legislation—the Amendments to the Education Act (more commonly referred to as Bill 82)—"which mandated universal access to education, and required boards of education in the province to provide special education programs." Ken was an early advocate at the Institute of Child Study, OISE, for children with special educational needs and sat as the chair of the Ontario Special Education Tribunal.[1]

Prior to this 1980 landmark legislation, schools and school boards in Canada were free to choose whether or not to admit exceptional students. However, beginning in the mid- to late-1800's, some provinces had already opened special schools for children with visual impairments and hearing impairments and, from 1920 through to the 1980s, there was a gradual increase in the numbers of segregated schools and classes for children with special educational needs. The publication of several influential reports, together with growing public and parental pressure, lobbying for integration, the right to free public education, and teaching based on the child's learning needs rather than disability category, all triggered the instantiation of teacher education programs in "special education" at Canadian Universities.[2-4] OISE itself provided comprehensive graduate training in special education throughout the 1980s and into the 1990s. Initially, in an attempt to comply with Bill 82, many Ontario school boards congregated exceptional students into specialized classrooms, segregated from the rest of the school population. There is currently a process of moving toward integration and inclusion (or at least its philosophy) of students with special education.

The move towards inclusive education has been motivated to some extent by research on the effectiveness of special education (or its lack thereof) as it operated during the 1980s and 1990s. However, the primary impetus for inclusive education has come from social justice movements (e.g., civil rights movements, legislation that prohibits discrimination), as well as from promising practices started by visionary educators. For example, the first use of the term "inclusion" in educational contexts has been credited to education authorities in Ontario in 1988.[5] Also, Marsha Forest and Jack Pearpoint co-founded the Centre for Integrated Education and Community[6] in Toronto in 1989 to foster the development of inclusion and call for the acknowledgement of the value and rights of citizens with disabilities.

Nonetheless, in this first decade of the 21st century, both the philosophy and practice of "special education" in Canada and other countries are in flux, teetering at the point where two paths diverge: one known and well-trodden path (sometimes successful) that tends to lead to the marginalization of students with exceptionalities, and one unknown and unproven, but which promises to lead to inclusion of all students. Most parents, educators, administrators, policy makers, and researchers have started along the unknown path, seeking processes and critical landmarks to ensure they are on the optimal route towards full inclusion of students with exceptionalities in both education and society.

Accordingly, in this issue of *Orbit* we have focused on several Promising Practices in Special Education, with a particular emphasis on those supporting inclusive education of students with high incidence exceptionalities in the elementary years. In most provinces, the classification of high incidence exceptionalities includes children who are gifted learners as well as students with language, learning, or behavioural difficulties. Our intent was not to provide a comprehensive examination of promising practices in special education in Ontario, but to offer glimpses into programs or practices that reflect the current trends and important themes in special education.

This issue reflects three important themes related to emerging practices in special education:

1. Prevention or risk-reduction for learning difficulties, which encompasses early screening and intervention, together with progress monitoring (see articles by Barnes & Wade-Wooley; Baptist et al.; Stewart);
2. Reconceptualization of exceptionalities, which includes more educationally relevant definitions and recognition that learning difficulties may arise from factors other than intrinsic ones (e.g., situational context and instruction). These advances in understanding of the various high-incidence exceptionalities also underscore the importance of providing a continuum of appropriate evidenced-based instruction and support from kindergarten to post-secondary level programs, as well as the active inclusion of parents and community in collaborative partnerships (see articles by Barnes & Wade-Wooley; Rubinsten; Ducharme; Foster; Damianakis).
3. Capacity building of school boards, educators, and other partners to implement best-practices in inclusive education. This is a key component of recent reforms and strategies related to special education put forth by the Ontario Ministry of Education and has motivated the design and implementation of sustainable and effective teacher Professional Development resources and programs (see articles by Drewett; Tannock & Martinussen).[7]

It is our hope that this special issue of *Orbit* will encourage you, in your role as educator, psychologist or other health professional, administrator, policy maker, parent, researcher, or student, to strive for and embrace inclusive practices at the start of the new academic year. To help, we have provided an annotated list of Internet-based resources that could be used to obtain information about specific exceptionalities (e.g., children with learning disorders, children with ADHD) and effective instructional practices that provide all students with access to the curriculum (with and without assistive technology).

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[1] Weber, K. (1993). *Special education in Ontario schools,* 3rd ed. Thornhill: Highland Press. (p. 6).

[2] Dunn, L. (1968). Special education for the mildly retarded. Is much of it justifiable? *Exceptional Children, 35,* 5–22.

[3] Hardy, M.L., McLeod, J., Minto, H., Perkins, S.A., & Quince, W.R. (1971). *Standards for education of exceptional children in Canada: The SESCC Report.* Toronto: Leonard Crainford.

[4] Roberts, C.A. & Lazure, M.D. (1970). *One million children: A national study of Canadian children with emotional and learning disorders.* Toronto: Leonard Crainford.

[5] Thomas, G. & Vaughan, M. (2005). *Inclusive education: Readings and reflection.* Berkshire, England: Open University Press, McGraw-Hill Education (pp. 1; 147).

[6] The Centre for Integrated Education and Community was renamed the Marsha Forest Centre in her memory. It is a registered Canadian Charity.

[7] Ontario Ministry of Education. (2005). *Education for All: The Report of the Expert Panel on Literacy and Numeracy Instruction for Students with Special Education Needs, Kindergarten to Grade 6.* Queen's Printer for Ontario. Available at: www.edu.gov.on.ca/eng.

DIRECTIONS FOR SPECIAL EDUCATION IN ONTARIO

Bruce Drewett

The Ontario Ministry of Education has established three major strategic goals upon which its policy direction and related professional development activities are based:

1. High levels of student achievement;
2. Reduced gaps in student achievement (including Special Education, Aboriginal and English Language Learners/ English as a Second Language student populations, and boys' literacy); and
3. Increased public confidence and support for public education.

Following recommendations made to the government by the Working Table on Special Education, in its report *Special Education Transformation* (May 2006), the Ministry has introduced several reforms to support better outcomes for students who receive special education programs and services in Ontario.

Improved outcomes for students receiving special education

Students with special education needs comprise almost 14% of the total student population. The Ministry is promoting a number of strategies to enable as many of these students as possible to be included in the government's targets of:

- 75% of all students performing at the provincial standard (Level 3) in Grade 6 reading, writing, and math provincial assessments by 2008; and
- an 85% secondary school graduation rate by 2010/11.

Planning for the attainment of these targets can be enhanced by carefully monitoring and analyzing Education Quality and Accountability Office (EQAO) student achievement results and exemption rates, as well as student achievement in classroom assessments as measured through the Individual Education Plan (IEP), where appropriate, and reported on the provincial report card.

Special Education Program and Financial Review

Nearly 300,000 students are reported by school boards to be receiving special education programs and services. The 2007/08 Special Education Grant is projected to increase by $51 million to a provincial total of more than $2.04 billion.

The Ministry is currently undertaking a special education program and financial pilot review in selected school boards. The purpose of this review is for the Ministry and school boards to work collaboratively to collect information about program and financial decision-making processes related to the planning and delivery of special education programs and services and to determine the results.

Boards selected use diverse special education program delivery models, for example: some boards offer special education programs in regular classrooms, while others offer a range of classroom placements; some offer special education programs only to students who have been identified as "exceptional" through the Identification Review Committee (IPRC), while others offer such programs to students who have not been formally identified as exceptional.

This review has been completed in two district school boards. Three more school boards, including one French-language board, were part of the 2006/07 school year review. Each participating board receives a report that summarizes the findings from their board. Upon completion of all reviews, the Minister of Education will receive a report outlining the trends, successful practices and challenges, and recommendations for a process of cyclical reviews for all boards to review their planning and provision of special education programs and services.

Increased capacity of schools to effectively meet the needs of a wide range of learners

The Council of Ontario Directors of Education (CODE) Special Education Project

CODE received $25 million in each of the 2005/06 and 2006/07 school years to work in partnership with the Ministry and collaboratively with Ontario's school boards to implement the recommendations contained in *Education for All: The Report of the Expert Panel on Literacy and Numeracy Instruction for Students with Special Education Needs, Kindergarten to Grade 6* (2005). The goal is to improve student achievement and to enhance the capacity of classroom teachers to develop instructional strategies based on the concepts of universal design for learning, differentiated instruction, and the use of assistive technology.

The project work is on-going, and the outcomes are positive thus far. A first-year report on the project outcomes for teachers is available on the CODE web site: www.ontariodirectors.ca; the second year report is scheduled for release in Fall 2007.

CODE's 2007/08 funding will leverage the program gains made in the previous two years and support the sustainability of new approaches to teaching and learning as demonstrated through these projects. School boards have been encouraged to consider ways to leverage this funding with resources provided through other initiatives, such as Lighthouse Projects, related to the Student Success initiative.

Ontario Psychological Association (OPA) Student Assessment Project

The OPA received $20 million in 2006/07 to work with school boards to reduce current waiting times for students who require assessments, and to enhance the capacity of teachers to provide effective programs for students. The focus is on JK–Grade 4 students who require differentiated learning experiences as a result of significant learning or behavioural needs. School boards are determining their assessment needs, which may include psychological, speech language, and social needs. The OPA will distribute a *Promising Practices* guide to boards in the coming months. The project completion date is scheduled for August 31, 2008.

Autism Spectrum Disorder Initiatives

The Ministry is undertaking or supporting a number of initiatives to assist school boards, school authorities and provincial/demonstration schools in teaching students with Pervasive Developmental Disorder (PDD)/Autism Spectrum Disorder (ASD). The Ministry has instructed school boards, through Policy/Program Memorandum No. 140, to provide programs that use Applied Behaviour Analysis (ABA) methods for students who need it. This directive is part of the government's response to the recommendations of the Autism Reference Group report, *Making a Difference for Students with Autism Spectrum Disorders in Ontario Schools: From Evidence to Action,* received in early 2007.

The implementation of ABA is supported by extensive staff training, starting with six to eight representatives, including superintendents, principals, teachers, teaching assistants, school support staff, and Special Education Advisory Committee members, from each school board. This is followed by school team training for principals, educational assistants, and teachers over the summer months. In addition, the Ministry is:

- implementing research-based collaborative approaches with school staff and community groups to deliver autism services to students, supported through a $2-million investment;
- providing $5 million in funding for the training of 5,000 educational assistants who work with children with autism through the Geneva Centre for Autism;
- requiring principals to have transition plans for students with autism when they start school, move between grades and schools, and move on to college, university, or the workplace;
- creating a resource guide for teachers, educational assistants, administrators, and other staff on the most effective ways to teach students with autism; and
- encouraging school boards to establish multi-disciplinary teams that include parents, and provide input to a student's IEP.

Web Based Teaching Tool

The *Web Based Teaching Tool* (WBTT) was developed by the Learning Disabilities Association of Ontario (LDAO), with funding support from the Ministry. The WBTT provides teachers with early screening and intervention strategies for students JK–Grade 2 who are at risk of having learning difficulties. Currently, 70% of school boards are utilizing this on-line tool. The Ministry will provide funding to LDAO in 2007/08 to consolidate, evaluate, and refine the WBTT.

Reinforcing the connection between the Individual Education Plan, the Ontario Curriculum, and the Provincial Report Card

The Ministry's Individual Education Plan Collaborative Review addresses a series of relevant recommendations related to the measurability and reporting of student achievement made by the Working Table on Special Education (May 2006). IEPs were submitted by all school boards. In addition, nine regional meetings took place between February and April 2007, across the province, with one meeting in each region (two each in the London and Barrie regions) and one provincial francophone session. School boards have received an individualized report, which provides feedback on the IEP packages they submitted as well as a report on provincial trends.

More cooperative connections between schools and families of children facing learning challenges: Promoting a positive environment

The Ministry is developing a resource guide for parents and educators with recommended approaches for working together to resolve disagreements regarding programs and services for students with special education needs. The guide will offer advice and guidance on conflict prevention and resolution techniques for use in classrooms and schools. Stakeholder consultation on the context of the guide was held in January 2007. The guide is scheduled for release in late Summer 2007. School board level team training will be offered by the Ministry on a regional basis in October and November 2007. In addition, the Ministry intends to pilot a formal dispute resolution process in selected school boards during the 2007/08 school year. To assist with the development of the pilots, the Ministry is engaging a provincial advisory committee. A provincial policy on formal dispute resolution will be developed following an evaluation of the pilots.

Improved balance between a focus on teaching and learning, and the need for appropriate process, documentation, and accountability

Identification, Placement, and Review Committees

In two Deputy Minister memoranda to school boards (October 12 and November 30, 2006), the Ministry requested school boards to examine their IPRC practices when both the board and the parent agree that the student's placement will be in the regular classroom. The Ministry continues to expect that IPRCs will be held when parents request them or when a self-contained or partially integrated placement is the likely destination for the student.

The Ministry's intent is to ensure that board administrative processes actually lead to improved outcomes. It also wants to ensure that these processes are not acting as barriers for students to receive timely and effective special education programs and services.

School board improvement plans

During the 2007/08 school year, the Ministry will work to align school board improvement planning processes, beginning with the Literacy and Numeracy Improvement Plans, K–Grade 6 and the Student Success Annual Action Plans, Grades 7–12. At the same time, the Ministry will conduct a process to determine appropriate measures of achievement and learning for all students with special education needs. All processes will include stakeholder involvement. During the 2008/09 school year, the Ministry will work to align the special education plan with the revised Literacy and Numeracy/Student Success plan. It is the intent to have aligned board improvement plans in place for the 2009/10 school year. In the interim, special education plans will continue to be amended annually.

The Ministry of Education looks forward to continued collaboration with Ontario's school boards, parents, and other education stakeholders on practices that will more effectively support improved outcomes for Ontario's students with special education needs.

FURTHER READING

- *Education for All: The Report of the Expert Panel on Literacy and Numeracy Instruction for Students with Special Education Needs, K–Grade 6*. (2005). Available at: www.edu.gov.on.ca/eng/document/report/speced/panel/speced.pdf.
- *Effective Educational Practices for Students with Autism Spectrum Disorders*. Available at: www.edu.gov.on.ca/eng/general/elemsec/speced/autismSpecDis.html.
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WHERE THERE'S A WILL THERE ARE WAYS TO CLOSE THE ACHIEVEMENT GAP FOR CHILDREN WITH LEARNING DIFFICULTIES

Marcia A. Barnes, Lesly Wade-Woolley

> *Children who get off to a poor start in reading (and math) rarely catch up. We wait—they fail, but it does not have to be this way. (Lyon et al., 2001)*

The number of children identified with learning disabilities, or LDs, has steadily increased since the establishment of LDs as a disability category in education 40 years ago (Fletcher et al., 2007). At that time, there was relatively little research to guide identification, prevention, and intervention (Lyon et al., 2001). However, in the past two decades, significant progress has been made in understanding the genetic and neural underpinnings of learning difficulties (Plomin & Kovas, 2005; Shaywitz & Shaywitz, 2005), identifying the cognitive processes underlying both typical and atypical development of academic skills (Siegel, 2003), developing prevention strategies (Vaughn et al., in press), and designing evidence-based instructional and intervention practices (Swanson et al., 2003).

An overview of the research on identification, prevention, and intervention—an understanding of which is critical for closing the achievement gaps in numeracy and literacy—is presented below.

Do our identification and assessment practices help or hinder the education of children with learning difficulties?

Our identification and assessment practices should be consistent with current scientific knowledge about LDs. Often, an LD is identified when there is an IQ-achievement discrepancy; that is, when intelligence is markedly higher than academic achievement. The use of this discrepancy to identify LDs came from the mistaken idea that IQ is a measure of learning potential—it isn't (Share, et al., 1989; Neisser et al., 1996). There is little scientific evidence for the usefulness of the discrepancy in identifying or treating LDs.

Children with learning problems who show large or small IQ-achievement discrepancies do *not* significantly differ from each other on:

i. the cognitive processes that are deficient (e.g., phonological processing in reading; [Stanovich & Siegel, 1994]);
ii. the genetic and neural underpinnings of the learning difficulties (reviewed in Fletcher et al., 2007);
iii. the level of reading acquired by the end of schooling (Francis et al., 1996); and
iv. how quickly or how well interventions work (Vellutino et al., 2000).

Furthermore, the tests used to assess IQ and achievement do not detect large discrepancies until about Grade 3 (Fletcher et al., 2007), yet children at risk for learning difficulties benefit most from earlier intervention.

LDs are also often identified by a set of exclusionary factors; such that the LD must *not* be due to mental retardation, sensory disorders, linguistic diversity, emotional or behavioural disorders, social or cultural factors, or lack of appropriate educational experiences (Ontario Ministry of Education, 2001; U.S. Office of Education, 1977). Although the first three of these exclusionary factors are reasonable, there are problems with the latter three. For example, many children with behavioural disorders such as ADHD have co-occurring LDs. One does not cause the other though cognitive and learning difficulties tend to be more severe when both disorders are present (Fletcher, 2005; Willcutt et al., 2001). Socio-economic and cultural factors interfere with the development of cognitive and language skills, which place a child at risk for later academic difficulties. Disadvantaged children begin school with half the vocabulary of non-disadvantaged peers (Hart & Risley, 1999), have much less knowledge of the alphabet (Whitehurst & Massetti, 2004), and less informal number and quantitative knowledge (Case et al., 1999). More importantly, the response of disadvantaged children to high quality instruction and interventions is similar to their non-disadvantaged peers (Case et al., 1999; National Reading Panel [NRP], 2000). Finally, excluding children from a diagnosis of LD if they have not had appropriate educational experiences assumes that instruction has been adequate and appropriate for that child.

What is the answer to identification if the traditional means of identifying LDs do not hold up to scientific scrutiny?

How can we deal with the diversity of children who have learning difficulties, some of whom may be living in disadvantaged circumstances, or have disorders such as head injury, Fragile X, or ADHD, or, for unknown reasons, just seem less able to learn how to read or do math?

How do we ensure children's learning needs are identified early so that prevention programs are in place to reduce the incidence of later learning difficulties?

How do we help children who do not respond to prevention programs or whose learning difficulties are caught late?

Prevention

The news on prevention of learning disabilities is good news. First, several studies have shown that the incidence of LDs can be significantly decreased: up to 70% of later diagnosed LDs can be prevented with a combination of early screening, progress monitoring, and teaching that is responsive to emerging learning problems (NRP, 2000). Second, we know that prevention works better for fixing some skills than does the best remediation introduced later in schooling. For example, while certain reading interventions instituted after Grade 2 can produce remarkable growth in word reading accuracy, reading fluency will be stubbornly resistant (Torgesen, 2004). Programs that work on the prevention of reading problems in Kindergarten and Grade 1, on the other hand, seem to remedy both reading accuracy and fluency.

The three cornerstones to prevention are:

- mass screening—for all children at school entry and in the early grades,
- progress monitoring—of children, particularly those who are at risk for learning difficulties, and
- evidence-based instructional practices.

Mass screening tools exist that are brief but can predict which children are at risk for academic and behavioural difficulties (Donovan & Cross, 2002). These are typically given at the beginning and end of the school year. Progress monitoring, a type of curriculum-based measurement, is the more frequent assessment of children's academic progress in relation to instruction. It might be used once a week for children identified at risk from mass screening. Progress monitoring tools are very sensitive to instructional change; they are widely available and are easy and *very* fast to administer. (More information about progress monitoring can be obtained at www.nasdse.org, www.studentprogress.org, and www.isteep.com). Progress monitoring puts information directly in the hands of teachers, which is critical for providing immediate and frequent feedback on student progress. It allows for better tailoring of instruction—a necessity for children at risk of learning difficulties (Stecker et al., 2005). Thus, teachers in the early grades may make instructional changes and increase the intensity or duration of instruction for children who are not responding to previous instruction. It is important to underscore that this type of monitoring and assessment process does *not* mean that children are labeled with an LD at an earlier age; it *does* mean that children receive the instruction they need when they need it. Prevention programs, progress monitoring, and tailored instruction all require considerable professional development and institutional support, particularly for teachers in the primary grades who are the first line of defense for children at risk.

Intervention

What happens when these attempts at prevention fail? Some children at risk for learning difficulties do not respond to the best prevention and early intervention programs. When schools have prevention models in place, children who do not respond to classroom-based instructional strategies can be provided with increasingly intensive interventions in a timely manner. Children who continue to show lack of progress may require some highly specialized and intensive small group remediation (e.g., Lovett's Empower™ program for reading, 2006).

Educators need not wait for a diagnosis of LD to begin intervening with children who are at risk for learning difficulties or who are not progressing as expected. In fact, a combination of early screening and instruction that is tailored to findings from teacher-driven progress monitoring from K–Grade 2 will reduce the later incidence of full-blown LDs. As is true for other societal problems, prevention is less expensive in terms of both financial and human resources than is intervention and treatment. Waiting for a diagnosis of an LD is tantamount to waiting for a child to fail. But despite the best screening, high quality instruction, and appropriate progress monitoring, some children will fail to make much progress in the normal classroom. The following eight instructional principles (Fletcher et. al., 2007) apply to these children, but they are also good instructional principles for all children.

EMPOWER™ READING PROGRAM

This remedial reading program is designed to address the core learning problems of struggling readers. The Decoding Program teaches a set of five specific, carefully-sequenced decoding strategies:

- Sounding Out
- Peeling Off
- Spy
- Rhyming
- Vowel Alert

The strategies give children the flexibility required to read the often unpredictable English language; each strategy builds and depends upon the mastery of previously taught skills and strategies. A metacognitive organizational structure is used to facilitate transfer of learning: the metacognitive emphasis of the program is designed to ensure that the child takes ownership of the strategies and can monitor their application independently.

The program is the result of findings from 25 years of research by Dr. Maureen W. Lovett and her team of psychologists, special education teachers, and scientists at The Hospital for Sick Children in Toronto.

Sample Exercise:

Child is presented with the word "unplowed"

"I'm going to use Game Plan to read this word. I see beginnings and endings and a double trouble twin so I'll use Peeling Off and Vowel Alert to figure out this word. First I'll use Peeling Off. I Peel Off *un* from the beginning and *ed* from the end. Now I'll use Vowel Alert on the double trouble twin *ow*. First, I'll try *ow* as in *glow* and then, I'll try *ow* as in *cow* and see what gives me a real word. First, I'll try *ow* as in *glow*. I sound out the word and see if it makes a word I know: *plllooo*. Now, I'll put the word together: *unpload*. It doesn't make a real word, but I don't give up. Now, I'll try *ow* as in *cow*: *plllowowow*. Now I'll put the word together again: *unplowed*. Yes, that's a real word! I used Peeling Off and Vowel Alert and I got the word!"

For more information on the Empower™ Reading Program and the Learning Disabilities Research Program at The Hospital for Sick Children, phone 416-813-6329 or email ldrp@sickkids.ca, or nbadger@sickkids.ca.

Improving literacy and numeracy in children with special education needs

1. **The instructional approach needs to be explicit and well-organized with opportunities for guided practice and cumulative review.**

One of the best sets of evidence for this type of instructional approach comes from the National Reading Panel (NRP, 2000) that analyzed over 75 studies on the effectiveness of phonics instruction. This analysis showed that studies in which phonics was taught systematically and explicitly were more effective for improving reading than were programs in which phonics instruction was implicit (or not taught at all), and not systematic. The effects were greatest when phonics instruction was introduced in Kindergarten and Grade 1.

Studies of math interventions are much less common and instructional programs for reading greatly outnumber those for math (Ginsburg et al., 1998). However, the findings on instructional approach are similar for reading and math (Baker et al., 2002).

Instruction for children with learning difficulties also needs to provide for a cumulative review of previously instructed and seemingly mastered content. It is a frequent complaint of teachers and parents that children with learning difficulties seem to have a concept or a skill one day, only to have it disappear the next. Children with learning difficulties have problems in consolidating, retaining, and transferring newly learned information and skills from one day to the next, and from one situation to another. That is why cumulative review is so important for these children.

2. **Skills-based instruction needs to be integrated with instruction in higher-level skills.**

The NRP report provided clear evidence that simply adding more phonics instruction to the classroom or to remediation programs without incorporating instruction in areas such as fluency, vocabulary, and reading comprehension does not improve reading outcomes. The most effective prevention and intervention programs for both reading and math integrate instruction in basic skills with higher-order skills. The most successful early prevention programs for reading are those that provide explicit instruction in the alphabetic principle, teach for meaning, and provide opportunities for practice. Impressive gains in higher order skills such as comprehension, written expression, and math problem solving can be achieved even when word decoding, spelling, and arithmetic are weak, but this only occurs if teachers are simultaneously instructing students in these higher-order skills (Wilder & Williams, 2001).

3. **Self-regulation strategies provide benefits over and above those provided by systematic explicit instruction.**

These strategies directly involve students in setting goals for their academic performance and require them to monitor and chart their progress. For example, in instructional studies designed to improve math fact retrieval and arithmetic procedures, students who selected their own learning goals had stronger learning than students who were assigned learning goals (Fuchs et al., 1989). In intervention studies of math problem solving, students who set goals and graphed and monitored their progress made the greatest gains (Fuchs et al., 2003).

4. Peer mediation is an effective method for extending instruction and results in more acceptance by peers.

Peer-assisted learning strategies (collaborative learning) involve small-group instruction and students working together on specific learning activities. These practices are useful at the classroom level because they aid in classroom management and provide a means to deliver tailored instruction (Jenkins & O'Connor, 2003). Many studies of math and reading have shown that pairing students who have stronger academic skills with those with weaker skills from Kindergarten on improves outcomes for students at all levels of achievement (Fuchs & Fuchs, 2005). Furthermore, students with special education needs are better known and better liked by their peers in classrooms that practice peer-assisted learning strategies (Fuchs et al., 2002).

5. Gains in literacy and numeracy are specific to instruction in literacy and numeracy.

Medication for children with ADHD plus a reading disability may help ease some of the behavioural and cognitive manifestations of the ADHD, but will not cure the reading disability (Rabiner et al., 2004). Despite some claims in the educational and psychological literature and the popular media, programs that provide training in neural, motor, visual, auditory, or cognitive processes that do not explicitly teach academic content simply do not improve literacy or numeracy.

6. Children with special education needs are complex and diverse but high quality instruction helps most children.

Most children with LDs have special education needs in more than one area. For example, 50% of children with reading disabilities also have math disabilities (Shalev et al., 2000). Children with certain neurological and genetic conditions are at high risk for LDs (Barnes & Fuchs, in press; Barnes et al., 2006). This is powerful information to have in terms of prevention, monitoring progress, and intervention. Even when a child's academic difficulties are confined just to literacy or numeracy, these children may have accompanying difficulties in attention, memory, planning ahead, and self-regulation that complicate how the learning difficulties manifest themselves, and that may dilute the effectiveness of particular interventions (Fletcher et al., 1999; 2007).

Fortunately, the cognitive sources of difficulties in reading and math, and the interventions that help children to learn literacy and numeracy skills are similar across diverse groups of children (Barnes et al., 2006). This does not mean that other issues such as attention deficits do not need to be taken into account, but it does mean that high quality teaching practices may help many children even when other conditions are present.

7. Practice makes perfect.

The aim of any special education instruction is to acc*elerate* growth of students with LDs and this requires more time spent on instruction and practice in those areas in which the student has the most difficulty. Increased practice and engagement for students with special education needs often also means time on tasks spent outside of school hours. For example, time spent on reading connected text outside of school helps with reading fluency, acquisition of new vocabulary, and consolidation of word reading and comprehension skills for children with special education needs—just as it does for typically achieving children.

8. Special education and general education need better integration.

There are many effective interventions for problems in word reading and comprehension, math computations and problem solving, and spelling and written composition, and many instructional components of these programs are similar to those that are effective in general education (see Lyon et al., 2006). If prevention and intervention programs are to be most effective for closing the achievement gap for children with special education needs, there needs to be a better integration of instructional design across general education and special education.

Effective prevention programs properly take place within general education. In turn, the classroom needs to be responsive to multiple tiers of effective general education in order for prevention to work. However, the best prevention programs will not address the learning difficulties of all children. Special education research and practice will need to focus on children who respond more slowly, or less well, to our interventions.

The explosion of intervention and prevention research in the past decade, mainly in reading, but increasingly in math and writing, provide evidence for what works and what does not work for students with special education needs, though much remains to be studied. Although research provides some of the means for closing the achievement gap, it is worth remembering that educational "research is only as good as its implementation" (Fletcher et al., 2007, p. 274).

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SCREENING IN THE EARLY YEARS FOR MATHEMATICS DIFFICULTIES AND DISABILITIES: IDENTIFYING RED FLAGS TO SUPPORT EARLY LEARNERS AT RISK

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During the Winter 2007 term at OISE, a group from the Institute of Child Study—four students and one faculty member—met in a weekly seminar to explore current research in the relatively new field of Mathematics Disabilities. The group investigated questions surrounding the differences between mathematics difficulties and disabilities, the causes of mathematics disabilities, how to screen for difficulties and disabilities, and how to provide early intervention for children who display early difficulties in mathematics. The following paper is a summary of the group's inquiry.

Current research suggests that approximately 5%–8% of school-age children struggle with mathematics, with poor conceptual understanding, immature counting and arithmetic strategies, and/or difficulty retrieving basic math facts (Geary, 2004). A major problem with this research literature, however, is that there are a variety of terms used when attempting to identify those with poor math achievement, including "math disability," "math difficulty," "dyscalculia," and "poor math achievement." This confusion leads readers to wonder whether these terms are mutually exclusive, synonymous, or overlapping. How does one differentiate among these terms?

In addition to the confusion in terminology, currently, early identification of math disabilities (MD) is confounded by a lack of standard, consistent diagnostic criteria and identification procedures (Geary, 2004). Researchers tend to view discrepancies between math scores on standardized achievement tests and IQ scores as evidence of math difficulties, casting a wide net in order to identify as many at-risk children as possible (Geary, 2004; Mazzocco, 2005; Mazzocco & Thompson, 2005). However, in identifying math disabilities based on scores lower than the bottom 20-25th percentile (Geary, 2004) or bottom 35th percentile (Gersten, Jordan, & Flojo, 2005) on math achievement tests, the number of children identified as having a math disability may be over-inflated. Relying solely on children's achievement scores fails to account for differences in experiences, background knowledge, and teaching instruction. This procedure also ignores the possibility of some type of "core" mathematics deficit. Furthermore, using a statistical measure of achievement does not account for any potential growth in performance over time (Geary, 2004).

Perhaps due to the problems in defining, diagnosing and identifying math disabilities on a theoretical level, screening tools specifically designed to identify difficulties and disabilities are currently unavailable (Geary, 2004). As a result, most school boards do not have standardized screening procedures in place to identify children at risk for difficulties or disabilities in mathematics.

Core deficits

In parallel with research into reading disabilities, the central task of researchers in the domain of math learning disabilities has become the identification of a core deficit underlying Mathematics Disabilities (Chiappe, 2005). Identifying this domain-specific cognitive deficit should facilitate the differentiation of students whose poor math achievement reflects a learning disability from students whose math difficulties relate to other factors (such as teaching practices, differences in background knowledge and experiences, etc.).

Based on current research, we suggest that there are qualitative differences between students with math difficulties and math disabilities that reflect differences in children's representation of numbers (Chiappe, 2005) or number sense (Bryant, 2005; Gersten, Jordan, & Flojo, 2005; Wilson, et al., 2006). We suggest that the term "math disability" (MD) be used to refer to those who display a mathematical "core deficit" and that the term "math difficulty" (MDiff) be used to refer to those who have low math achievement due to other deficits, but whose "core processes" are intact. One could draw an analogy between math disabilities and reading disabilities, an area of study supported by seemingly infinite research. It is now widely accepted that the core deficit of reading disabilities is a deficit in phonological processing (Moats, 1998; Torgeson, 1999), and very specific brain regions have been associated with this domain. Despite the role of phonological core deficits, there exist students who have difficulties with reading and language despite having intact phonological processing abilities.

During the early school years (e.g., by the end of Kindergarten or beginning of Grade 1), number sense reflects children's ability to map their understanding of magnitude and related math vocabulary (e.g., more/less, bigger/smaller, etc.) onto a mental representation of numbers (Case et al., 1996; Gersten et al., 2005). Number sense, then, reflects children's ability to represent and manipulate numbers on a mental number line. This involves the coordination of children's counting ability and their general magnitude discriminations into a coherent framework that allows them to recognize, for example, that 9 is "bigger than" 7 (Case et al., 1996). A further difficulty in the research literature exists in terms of defining "number sense"—"no two researchers have defined number sense in precisely the same fashion" (Gerston et al., 2005; Mazzocco, 2005).

In this view, children with MD have difficulty coordinating their developing counting skills with their ability to discriminate magnitude into a mental representation of number. This core deficit is a biologically-based disruption in the concept of number sense. Chiappe (2005), has suggested that any underlying core deficit of MD must be domain-specific, rather than involving domain-general processes such as processing speed, automaticity, or general auditory processing; however, these and others may certainly play respective roles in the manifestation of MD. This conception of a core deficit in number sense leads to persistent difficulties with mentally manipulating numbers and retrieving mathematical facts that tend not to improve across age or grade (Gersten, 2004). In contrast, we argue that MDiff reflect procedural deficits, or immature counting strategies and procedures. These difficulties may be a result of deficit(s) other than a disruption in number sense, such as in counting, visual-spatial processing, working memory, executing function fluency, and processing speed. Other related possible factors for difficulties and low achievement could include home environment, family background, poor instructional techniques, and confusing or poorly written textbooks (Fleischner & Manheimer, 1997). Children with this type of MDiff frequently use developmentally immature counting procedures and show frequent errors and lack of understanding of counting and arithmetic strategies (Geary, 2004). Performance often improves with additional practice and instruction, suggesting that these difficulties represent a developmental delay rather than a lasting cognitive deficit (Gersten, 2004).

Children with math difficulties are qualitatively different from children with math disabilities. Although children with MD will most likely exhibit symptoms similar to children with MDiff, the root cause of the poor math achievement differs in these two cases. The screening tools and interventions for these two categories of struggling students should therefore differ, with assessments focusing on counting and procedural knowledge to identify MDiff and assessments focusing on number sense to identify MD. Table 1 outlines some of the differences between "red flags" for MDiff and MD.

Screening for MDiff and MD

Robbie Case has argued that children's early number sense is developing by the age of six (Case, et al., 1996)—as a result, teachers should be able to identify early warning signs

TABLE 1

RED FLAGS—Possible indicators of MDiff (Math Difficulties)	RED FLAGS—Possible indicators of MD (Math Disabilities)
• **Counting**—immature counting strategies, more errors, more effortful • **Computing/retrieving basic facts**—errors and longer response times in retrieving basic facts from long-term memory • **Working memory**—deficits are not necessarily specific to numbers and manipulating numbers • **Speed of processing**—deficits are not specific to numbers (e.g., rapid automatized naming task for letters, objects), may be aspect of "garden variety" learning disability • **Number representation**—poor but intact, more easily enhanced by quality instruction • **Procedural delays**—e.g., following multi-step problem-solving procedures • **Visual and spatial processing**—e.g., difficulty aligning digits during multi-digit addition/subtraction, sequencing objects, place-value errors • **Difficulty with the reading and/or writing of numbers** • **Confusion of arithmetical operations** • **Response to intervention**—students respond well to interventions that focus on counting and number sense	• **Working memory**—deficits are specific to numbers and manipulating numbers (e.g., poor backward digit span, number sequencing) • **Speed of processing**—deficits are specific to numbers (e.g., number recognition, magnitude discrimination) • **Number representation**—deficit in this area, not easily enhanced by quality instruction; poor digit identification skills, magnitude discrimination; poor number line concepts • **Conceptual deficits** • **Response to intervention**—students do not respond well to interventions that focus on counting and number sense; however, gains can be made

of MD by the end of Senior Kindergarten (SK) or the beginning of Grade 1. However, screening for MDIff can start much earlier to ensure a positive trajectory in a child's education and possible early identification of MD. It is unfortunate that although it is often argued that prevention and early intervention are the most successful ways to support and enhance the learning of all students, assessments typically do not occur until the middle or end of Grade 1 or 2. In the case of math, by this stage the "students may be failing to acquire critical mathematical knowledge that will form the basis of later understanding. Educators need tools to identify these at risk children before problems occur" (Clarke & Shinn, 2002, p 7).

Proper screening and early interventions need to start as soon as students enter a formal classroom setting—in Ontario: Junior Kindergarten (JK). Teachers can begin to identify students who are struggling with math difficulties and modify supports, helping to develop appropriate and useful strategies to support future learning. At this early stage, MD may not be able to be identified—however, over time children with MDiff can be monitored and supported in order to determine whether the difficulties can be remediated or whether there is a MD based on a core deficit in number sense. Universal screening of all children is essential given the diversity of experience the students have when they start school. It is very difficult to know whether a student is struggling in mathematics in JK as a result of difficulties that can be remediated with good instruction, or as a result of a disability based on a core deficit in number sense and number representation. By screening and providing sound early intervention at this earliest stage, we can start to support students with MDiff and MD.

Junior Kindergarten screening

In JK (ages 3–5), students are using math that is useful to their everyday life (e.g., knowing how many cookies are on a plate), or math that has been specifically taught to them by their parents or at a pre-school. Knowledge of numbers and mathematical concepts is very limited. Basic counting skills and other straightforward mathematical concepts (e.g., counting and number representation) should be the focus of any assessment or screening tools used at this time, not higher order skills.

Recent studies by Geary (2006) suggest that MDiff, especially during the early years, will mostly likely result in frustration, avoidance, and anxiety which can in turn make math learning much more difficult and create a vicious circle that is very difficult to alter.

At the JK level, it is not the teacher's job to push all students to be at the same level but rather to ensure that each student is working towards moving forward and being exposed to as many different experiences and instructional techniques as possible. It is the students who do not appear to be progressing over the year, even with good instruction, who can be "red flagged" for future teachers to monitor, and potentially, deliver increased and more personalized instruction.

At the JK level, Geary (2006) has suggested the following risk factors for developing potential math difficulties:

- inability to identify basic number names,
- difficulties with quantities associated with small numbers,
- inability to count small sets of objects,
- not understanding that subtraction results in less and addition results in more.

Based on the research cited, we suggest that one of the most effective approaches to screening children at the JK level might be a response-to-intervention (RTI) approach. RTI is an effective tool to help determine what difficulties individual students are having, why they are struggling, and, which hopefully will prevent further academic struggles (Fuchs et al, 2005). A student's progress is recorded at specific intervals and their program can be altered based on their performance and their response to various interventions (Fuchs et al. 2005). The RTI approach can be adopted at a very early age to maintain consistent results about a student's progress. The recorded learning curve documented by the RTI approach can later support proper and accurate diagnosis and identification of MD. In order to take an RTI approach, teachers need some form of Curriculum Based Measure.

An example of a Curriculum Based Measurement package to support a RTI approach to screening is the Test of Early Numeracy (TEN) by Clarke and Shinn (2002) available through AIMSWeb (www.aimsweb.com). The Test of Early Numeracy measures are designed to look at the four basic number sense abilities important in early Kindergarten development, including:

1. Oral counting,
2. Number Identification,
3. Quantity Discrimination,
4. Missing Number.

In order to be able to determine whether students are benefiting from instruction, as they monitor for signs of MDiff, classroom teachers need to be addressing these very skills. Arthur Baroody (1987) suggests in his book *Children's Mathematical Thinking* that students who have early difficulties with counting may benefit from using more hands-on, concrete manipulatives in addition to being explicitly taught skills such as number representation or one-to-one correspondence. To support early counting, Kindergarten mathematics programs also need:

- to build fluency in arithmetic combinations (basic math facts),
- explicit instruction in prerequisite skills such as counting,
- basic number sense principles (counting, quantity), and
- explicitly taught mathematics vocabulary.

(Bryant, 2005; Gersten et. al, 2005)

Senior Kindergarten and Grade 1 Screening

In the same way children in JK can be screened for MDiff using a RTI tiered intervention approach (Bryant, 2005), screening in SK and Grade 1 can start with a RTI approach. The first tier of this approach involves universal screening for math difficulties (e.g., at the beginning of JK and continuing in later grades) and evidence-based teaching practices that benefit all students. Students identified at risk for potential MDiff may then move to a second tier of support and receive additional instruction in counting strategies and magnitude discrimination. Student progress is monitored and instruction is adjusted accordingly. By the end of SK or beginning of Grade 1, teachers may begin to identify students who are not benefiting from ongoing instruction and require additional screening for a potential MD (the third tier). Teachers can examine struggling students' progress in math over the last year to assess both achievement and rate of growth. Children displaying little growth (i.e., the flattest trajectory), or low achievement scores, may be at risk for a MD (Fuchs et al., 2005). This form of RTI has been demonstrated to be a useful diagnostic indicator of MD (Bryant, 2005; Fuchs et al., 2005; Geary, 2004).

As part of the screening process in JK, teachers can flag students who are experiencing difficulties and provide additional supports. Students not responding to good instruction can then be flagged for further screening. However, this screening process may not necessarily identify students with MD. In order to screen for MD, teachers need to identify students with deficits in number sense or how well students represent numbers.

One of the best recognized measures of number sense is the Number Knowledge Test (Case et al., 1996). The Number Knowledge Test has been demonstrated to be highly predictive of MD, comparable to the predictive validity of measures of phonological awareness for reading disabilities (Chiappe, 2005). In addition to the Number Knowledge Test, several additional measures can be used to assess number sense or number representation.

Assessing Number Sense or Number Representation

- Quantity Discrimination
  - — Students orally identify bigger and smaller numbers in a set.
  - — Example: "Which number is bigger: 5 or 4?"
  - — Number Knowledge Test, level 1 (copies available at: www.nap.edu/openbook.php?record_id=10019&page=198)
- Missing Number
  - — Students orally identify the missing number from a string of numbers (between 1 – 10 for Kindergarten, and between 1 – 20 for Grade 1).
  - — Example: "What number goes in the blank? 5 __ 7"
- Backward Digit Span
  - — Students orally repeat numbers in the reverse order of that presented by the tester. Performance can be compared to performance on backward letter naming and backward picture naming to identify difficulties specific to MD.
  - — Example: "I am going to say some numbers, and I want you to say them back to me backwards. If I say 6 – 3, then you would say 3 – 6."
  - — Formal versions of this task are available, however, this type of information can be collected informally.
- Rapid Automatized Number Naming (RAN) Task
  - — Students rapidly name numbers.
  - — Performance can be compared to children's ability to rapidly name letters, colours, and pictures to identify difficulties specific to MD.
  - — Formal versions are available, however, informal data can be collected for screening purposes.

We argue that children's conceptual understanding of number sense should be the primary target of screening and intervention for children at risk of MD. Activities that promote the integration of counting skills and magnitude discrimination onto a mental number line should assist children in mentally representing numbers (e.g., activities that focus on counting with one-to-one correspondence using a visual number line, quantity discrimination activities that use a visual number line, etc.). At the same time, the precursors of number sense should be individually targeted, promoting children's counting skills and strategies on the one hand, and their magnitude discrimination (e.g., bigger/smaller comparisons) on the other hand.

Baroody (1987) provides some examples of games to help struggling students with enumeration skills and the cardinality rule.

- Hidden Stars
  - — A game, or intervention, that focuses on helping struggling students with their enumeration skills and the cardinality rule.
- Car Race
  - — A game that focuses on practice for enumeration and production of numbers.
- Turn Over
  - — A slightly harder game that helps students with difficulty learning the number just before or just after a given number in a sequence, using the numbers 1–9.

Wilson et al. (2006) discuss an adaptive computer game program that intends to remediate students with dyscalculia, www.unicog.org/main/pages.php?page=NumberRace. The Number Race Software is intended to train students to perform on a numerical comparison tasks that are displayed in an entertaining format (Wilson et al., 2006). Wilson et al. (2006) argue that the key to using a computer-based software program as an intervention is that it needs to be effective in developing a student's individual skills and it needs to be exciting and engaging enough that the students will want to continue working through the problems the program provides. Regardless of the intervention employed, it is important to continue to monitor student progress and to adjust interventions based on student performance. (See page 21 for more examples of software and games.)

Conclusion

Mathematics Disability (MD) is a prevalent learning disability with long-lasting implications. Early identification and interventions, however, can boost student performance and increase student success (Fuchs et al., 2005), limiting the detrimental effects of MD. Early screening and intervention may also help to identify Mathematics Difficulties (MDiff) before the students develop a pattern of frustration and failure in mathematics.

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UNRAVELLING TERMINOLOGY FOR LEARNING DIFFICULTIES IN MATHEMATICS

A range of terms are often used to refer to problems in learning mathematical concepts and skills, including: Math Difficulties, Math Disability, Mathematical Learning Disability, Mathematics Disorder, Specific Disorder of Arithmetic Skills, Math Anxiety, and Developmental Dyscalculia. These terms are similar but not synonymous and subtle differences in their meanings can have important implications for the field of education, as indicated below.

Mathematical Difficulties

This term is generally used to refer to transitory difficulties in learning math, which may be attributable to many factors, such as disadvantaged backgrounds or inadequate instruction. Children with math difficulties may score somewhat low on tests of mathematical achievement (e.g., 16th to 25th percentile or standard score between 85 and 90), but they do not manifest a specific learning disability. These children are likely to show a good response to effective classroom instruction in math and would not need intensive individualized instruction.

Mathematics Disability/Mathematics Disorder

These terms are used commonly in North America: the former is used in education and psychology, whereas the latter is a medical term used in the Diagnostic and Statistical Manual for Mental Disorders (DSM-IV). Both terms refer to unexpected difficulties in learning math that are persistent and impairing and cannot be attributed to below average intellectual ability or to inadequate schooling. In other words, these terms refer to a specific learning disability. The term "unexpected difficulty" is typically defined in terms of a substantial discrepancy between an individual's scores on standardized tests of arithmetic or mathematics and general intelligence. Impairments may occur in other domains of functioning, including language and reading, as well as in arithmetic and broader aspects of mathematics. Inherent in this concept is that impairments in a common underlying factor (e.g., working memory, processing speed, information processing) may underlie learning difficulties in both reading and math. These children are unlikely to show a good response to effective classroom instruction in math and would need intensive individualized instruction in all three domains of arithmetic (basic math facts, algorithmic computation, word problems), as well as other cognitive domains, such as working memory and fluency in processing symbolic information.

More recently, some North American scholars have used the terms Mathematical Learning Disability, Mathematical Disability, and Dyscalculia (see below) synonymously. In this body of research, this common construct is identified as being a biologically based, domain-specific, "core" cognitive deficit in "number representation" or "number sense." This conception of a number sense core deficit is similar to the phonological core deficit identified as being at the root of reading disabilities. Modularity allows for this specific Mathematical Learning Disability to be present with or without other difficulties or disabilities. Domain-general deficits (for example, working memory or processing speed) are not included in this construct. Mathematical Learning Disability is, therefore, differentiated from (i) Mathematical Difficulties (poor mathematical achievement as a result of a variety of non-biological causes) and (ii) difficulties in different aspects of mathematics stemming from a variety of other biologically based disabilities (e.g., mathematics problem solving difficulties as a result of a reading disability or computational difficulties as a result of general working memory deficits). (See also Baptist et al., page 14) The best recent example of researchers using the term Mathematical Disabilities in this way is the recent book: *Why is Math So Hard for Some Children? The Nature and Origins of Mathematical Learning Difficulties and Disabilities,* (2007), edited by Daniel Berch and Michèle Mazzocco (Baltimore: Paul H. Brookes).

Specific Disorder of Arithmetic Skills

This classification term comes from the World Health Organization taxonomy (International Classification of Disease: ICD-10). It is used to refer to specific and unexpected learning disabilities in arithmetic skills and specifically excludes individuals with concurrent difficulties and disorders in reading (both word decoding and comprehension) and spelling, or who have had inadequate school experience. This definition requires that the child has at least an average IQ, but would score very low on a standardized arithmetic test (specified as at least 2 standard deviations below the level expected for their age and general intelligence: generally interpreted as math achievement scores below 10th percentile or standard score less than 80). Scores on IQ tests and on standardized reading tests would be at least in the average range (i.e., above 10th percentile, or standard score of 80 or higher). Inherent in the ICD-10 definition is the assumption that underlying cognitive impairments are specific to arithmetic and differ from those underlying reading disabilities (i.e., phonological processing) and so will need specific types of intervention focused on arithmetic. Thus, these students would be unlikely to respond well to effective class-wide instruction in math, but will need specific, intensive, and individualized intervention—probably in all three domains of math (math facts, algorithmic computation, word problems).

Mathematical Anxiety/Math Anxiety

This refers to feelings of tension and anxiety, negative cognitions, and avoidance behaviours, which interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations. Students with math anxiety might benefit from an increase in the positive atmosphere of math instruction, provision of frequent positive reinforcement for attempting the assigned math work, and working collaboratively with peers.

Developmental Dyscalculia (DD)

This term is used mainly in Europe. It differs conceptually from the other constructs in several important ways:

1. The learning problem is specific to the domain of arithmetic and requires reading and spelling skills to be within normal range;
2. It manifests as problems in learning and remembering simple arithmetic facts (e.g., 3+4=7), rather than more general problems in computation;
3. It is currently understood to reflect a specific impairment in brain function that gives rise to unexpected problems in basic *numerical* processing, such as automatic or implicit processing of quantities or numbers;
4. It is typically defined by very low scores on standardized tests of arithmetic achievement score (e.g., below 8th or even 5th percentile, which is equivalent to standard scores below 78). Thus, a diagnosis of DD would likely apply to only a subset of individuals with a diagnosis of Mathematics Disorder, Mathematics Disability, or Specific Disorder of Arithmetic Skills, since the latter three diagnostic categories may also include individuals with problems in arithmetic procedures without specific difficulties in numerical processing (e.g., carrying, borrowing, multiplication, long division, etc). Notably, DD persists into late adolescence, with inattention (particularly reported by teachers) being one of the strongest predictors of persistent DD. Students with DD will require intensive, individualized, and focused intervention (akin to that for phonological processing deficits) to improve the basic abilities in understanding magnitude, quantity, and automaticity in simple math facts. (See also Rubinsten, page 20.)

R.T. & J.M.

INTERVENTIONS FOR STUDENTS WITH DEVELOPMENTAL DYSCALCULIA

Orly Rubinsten

Most diagnostic criteria use the term Developmental Dyscalculia (DD) when correct and fluent numerical computations develop moderately or with huge difficulty. As usually quantified in most parts of western society, an adult or child scoring at least two standard deviations below the norm for his or her age on standardized tests of mathematical ability would be considered to have skills in the dyscalculic range. The diagnosis is considered to be one of "specific mathematical disorder" if mathematical scores are discrepant with overall IQ, and cannot be attributable to sensory difficulties or educational deprivation (for review see Geary, 2004; 2005; Butterworth, 2005).

Developmental Dyscalculia and basic numerical abilities

Children with DD fail in many numerical tasks, including performing arithmetical operations, solving arithmetical problems, and using numerical reasoning (Geary, 2005).

According to Gersten and his colleagues (Gersten, Jordan, & Flojo, 2005), there are four main measures that are found to be reliable indicators of potential DD in kindergarten children:

1. magnitude comparison,
2. sophistication of counting strategies,
3. identification of numbers, and
4. verbal working memory.

Most recently, however, DD is understood to reflect a specific disability in basic numerical processing, such as automatic or implicit processing of quantities or numbers (Wilson et al., 2006a, b; Rubinsten & Henik, 2005, in press). This is based on the assumption that animals and humans have an innate core number system that is rooted in evolution, and permits mental representation of quantities or magnitudes (e.g., Kobayashi et al., 2005; Dehaene et al., 2004). Core numerical abilities are still discernible in older children and adults and form the building blocks for the development of counting, which is the basis of arithmetic. For example, children learn that adding requires putting two or more sets of quantities together and counting the members of their union.

Even at the national level, some countries have come to understand the importance of basic numerical processes in DD. For example, in England, the Department for Education and Skills (DfES, 2001) defined DD with more emphasis on basic numerical abilities:

> *A condition that affects the ability to acquire arithmetical skills. Dyscalculic learners may have difficulty understanding simple number concepts, lack an intuitive grasp of numbers, and have problems learning number facts and procedures. Even if they produce a correct answer or use a correct method, they may do so mechanically and without confidence. (DfES, 2001)*

Moreover, it is true that mathematical achievement is cumulative throughout and beyond the elementary school years with quantitative and qualitative changes occurring within and across grade levels. However, there is reason to believe that DD is a persistent condition, and that dysfunctions in basic numerical abilities are permanent (Butterworth, 1999). Rubinsten and Henik (2005, in press), for example, have tested several intelligent and well-educated university students who showed difficulties in basic numerical processing. Ostad (1999), and Shalev and her colleagues (1998) also noted the persistence of this condition. Longitudinal studies can help narrow the current gap in our knowledge, but only a few such studies have been conducted (e.g., Geary & Hoard, 2001; Jordan et al., 2003; Shalev et al., 1998).

Intervention

Several studies have provided behavioural evidence that interventions providing training in number sense (i.e., implicit and automatic understanding of quantities), coupled with numeric decoding skills (i.e., establish the link between number and quantity), can benefit children and adults with mathematical difficulties. For example, Rubinsten and Henik (2005) have shown that by asking university students with DD questions that are strongly related to magnitude (e.g., which one of the two numbers is larger), numerical processing was more efficient and automatic than when questions were less or not at all associated with magnitude (e.g., which one of the two numbers is darker). This may suggest that in the case of DD, teaching mathematics should be in the context of magnitude.

Griffin (2005; 2004a, b; 2003a, b) have shown how playing games that involve quantities helps children structure and understand the world and limits their chances of developing mathematical disabilities. Griffin's work shows very convincingly that by exposing children to the many different ways that number and quantity is represented and talked about, children can then use the number knowledge they acquire flexibly and across contexts.

Specifically, Griffin argues that teachers should:

- build on children's current knowledge,
- select learning objectives that are a natural next step for children,
- make sure children consolidate one level of understanding before moving on to the next, and
- give children opportunities to use number concepts in a broad range of contexts and to learn words for describing quantity in each context (bigger, farther, heavier, hotter).

Griffin has shown how true understanding of very basic numerical concepts enhances computational fluency, number sense, mathematical reasoning, as well as performance on standardized mathematics achievement tests.

Researchers Robert Siegler, Robbie Case, and Sharon Griffin have developed a computer-based software curriculum called Number Worlds, to teach the central conceptual structure to Kindergarten students. After one year, at-risk children performed at the same level as their more affluent peers. The software also includes a screening tool (see www.sranumberworlds.com or http://clarku.edu/numberworlds). These same researchers developed a program called Rightstart "to create that learning experience" (Griffin, Case & Siegler, 1994). They showed that children who went through the program demonstrated increased number sense compared to a control group. The improved number sense also showed up in related contexts such as science, telling time, and dealing with money.

Based on current knowledge of the brain circuits underlying number sense, Wilson and Dehaene (2006a, b) developed the Number Race Software. It is designed for remediation of dyscalculia in children ages 4–8. It takes into account two potential as to the deficit underlying dyscalculia; a) impairment in number sense itself, and b) impairment in the links between the quantity representation and the symbolic representations of number. At this stage, it has been shown that the software may be useful, at least for children ages 7–8 and under. There is potential to use the software to investigate different causes and subtypes of dyscalculia (see: www.unicog.org/main/pages.php?page=NumberRace.)

PLAYING WITH NUMBERS

Software and games to help children to improve number sense:

Electronic Abacus
Just one of the many activities available through the National Council of Teachers of Mathematics.
http://illuminations.nctm.org/ActivityDetail.aspx?id=8

Games & Puzzles
Activities to help children understand, apply, and enjoy mathematics.
www.alabacus.com

Number Worlds
A prevention/intervention math program.
www.sranumberworlds, and
http://clarku.edu.numberworlds

The Numbers Race
An adaptive game that trains number sense with single digit numbers, numerical comparison, simple (1-digit) addition and subtraction.
www.unicog.org/main/pages.php?page=NumberRace

New brain imaging examinations of the neural effects of such behavioural studies are starting to provide a better understanding of how such programs may improve or change skills (Delazer et al., 2006; Ischebeck et al., 2006).

Specifically, humans have at least two distinct means of representing and processing numerical information, which involve different neural networks (Dehaene et al., 2003; Eger et al., 2003). One involves the left inferior frontal lobe and bilateral angular gyri, which are associated with linguistic representation (numerical symbols, concepts, and rules); are activated during exact calculation; and serve a more supportive role in the management of successive arithmetic operations in working memory and in rote verbal memory.

Another involves a specific part of the parietal brain region (horizontal intraparietal sulcus) that plays a central role in basic representation of numerical quantity, which is amodal and language-independent. Notably, children with dyscalculia who exhibit problems with basic processing of quantity have been found to have anatomical and functional abnormalities in the intraparietal sulcus (Kucian et al., 2006; Molko et al., 2003, Issacs et al., 2001). Ischebeck and her colleagues (2006) showed how training could shift processing from quantity-based support by the intraparietal sulcus to more automatic retrieval from memory supported by the angular gyrus. Assuming that people with DD suffer from abnormalities in the intraparietal sulculs, Ischebeck's findings may suggest that people with DD will find it a problem to shift during training to a more automatic and efficient way to calculate. Hence, initial good understanding and processing quantities (e.g., Wilson and Dehaene's software) may help with this process.

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THE 5TH BLOCK: A READING INTERVENTION PROGRAM

Brenda Stewart

The 5th Block is an early intensive literacy intervention. It was developed in 1998 by Toronto Catholic District School Board staff to be an additional support for the Balanced Literacy program, which is the delivery model for literacy instruction in all primary classrooms in the TCDSB.

In the TCDSB, all primary students participate daily* in four blocks of literacy:

- Word Study,
- Shared & Guided Reading,
- Read-Aloud & Self Selected Reading, and
- Writing.

Teachers have found that although most children make significant gains in their reading skills and ability within this two-hour framework for literacy instruction, some students still fall behind their classmates. For some, the gaps in their literacy development are greater than what can be addressed through regular classroom instruction. These students require extra support in order to develop their reading skills more effectively. They need a more intense literacy block that addresses their specific needs directly.

A fifth literacy block, 5th Block, grew out of this need. This extra block was developed for students in Grades 1 and 2 who need additional support in developing their reading skills. It was designed to provide intensive, high-quality instruction to students who have gaps in their literacy development, allowing them to succeed before they enter a cycle of failure. By receiving instruction at a measured pace during the beginning-to-read stage, students can realize their potential to be able readers in the regular classroom.

5th Block is a short-term, curriculum intervention program, not a special education program. Students participate in the intervention for a set period of time—one hour a day for approximately 17 weeks. It is intended to support those students whose needs can be met within this short timeframe. The instructional practices within the 5th Block reflect classroom instructional practices. Studies have indicated that intervention programs that closely resemble classroom practices are the most successful (National Reading Council, 1998; Pikulski, 1998). 5th Block students are able to apply these new skills and strategies in their regular class, which then reinforces their learning. 5th Block teachers teach directly to the areas of weakness of the students within the group. Skills are taught through high quality, explicit instruction, modeling, sharing, and the gradual release of responsibility. Over the course of the intervention, students gain confidence and competence in applying these skills to their regular class work. The ongoing explicit instruction and guided practice in the 5th Block classroom, together with authentic regular classroom application of these skills, reinforces and solidifies the learning for the students.

Student selection

5th Block is an intense intervention. The teacher works with a small group—no more than six students at one time. The model of instruction is small group. This is possible because the students are placed in groups based on their literacy needs and their reading level. It is as if the students participate in a one hour, uninterrupted, small group guided reading session every day. (This of course is not possible in a regular classroom setting.) The 5th Block teacher is able to teach directly to the needs of the students within the group. The use of running records allows the teacher to adjust his/her teaching based on the changing needs of the students within the group. Assessment informs instruction. Literacy skills, knowledge, and strategies are developed through working with words activities, read-aloud, shared, and guided reading activities. Students receive intense, individual attention in this small group setting with this instructional framework.

Grade	Reading Level	Session Dates
Grade 1	Kindergarten	February–June
Grade 2	Kindergarten/ Early Grade 1	Fall–end of January

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*In half-day kindergarten classrooms, this instruction is balanced over the course of a week.

Students attend just one session during the school year, but may attend in both Grade 1 and 2.

Elements of the 5th Block Program

Each hour-long class consists of 30 minutes of Word Study and 30 minutes of Shared/Guided Reading. Word Study skills are built and students are taught how to apply these skills to their reading.

Word Study

Phonemic Awareness

- rhythm and rhyme of words
- parts of a word
- separation of sounds
- sequence of sounds
- manipulation of sounds

Letters and Sounds

- letter recognition
- sounds of letters
- combinations of letters (chunks)

High Frequency Words

- word wall activities (develops a large store of frequently seen words that the students know by sight)

Word Patterns

- recognition of familiar patterns of letters found in families of words
- learning to transfer and apply these familiar patterns to new words

Shared Reading

- students and teacher share in the reading of a big book, chart story, or poem (the text is large enough for all to see)
- teacher models reading and the use of the strategies as the text is read
- students interact with the text as word study and comprehension skills and strategies are applied and reinforced

Guided Reading

- direct instruction of reading strategies
- students read books that are at an appropriate level for their reading ability, based on running records
- students learn to incorporate reading strategies to figure out unknown words and to derive meaning as they read
- students reread these texts independently to build fluency and confidence on subsequent days.

Oral Language

Research suggests a close link between vocabulary and oral language development and reading (Cunningham & Stanovich, 1997; National Institute of Child Health and Human Development, 2000; Ontario Ministry of Education, 2003; Spencer & Guillaume, 2006). Accordingly, oral language plays a prominent role in 5th Block classrooms. Vocabulary instruction forms an integral part of both the Word Study and the Reading blocks.

Read-Aloud stories help to develop oral language skills for both listening and speaking. Students build vocabulary and topic knowledge, an understanding of how text works, and English language structure.

Results

5th Block students are assessed on specific literacy skills and knowledge at the beginning and end of the program. Tracking of these results over the course of several years has indicated that most students gain between 5 and 7 reading levels by the end of the program—based on the reading levels of Fountas and Pinnell (1996).

Grade	Reading Level Start of Program	Reading Level End of Program
Grade 1	Kindergarten	Mid to end of Grade 1
Grade 2	Kindergarten/ Early Grade 1	Early Grade 2

WHAT DO GOOD READERS DO WHEN THEY DON'T KNOW A WORD?

- Look at the ***picture***.
- Look at the ***beginning letters*** of the word, ***say*** the first sound, and ***think*** about the ***picture***.
- Look for what you know ***in*** the word (chunks, blends, word families).
- ***Sound out*** the letters and chunks.
- In a longer word, ***cover up*** part of the word and sound out the letters and chunks in ***small sections***.
- ***Skip the word***—read the rest of the sentence then come back and try to figure out what word would ***make sense*** in the sentence.
- See if the sounds in the guessed word ***match*** the written word.
- ***Try another*** word if it doesn't fit or make sense.

DOES IT MAKE SENSE?
DOES IT LOOK RIGHT?
DOES IT SOUND RIGHT?

Support, encouragement and reinforcement of the skills gained during the 5th Block session must be continued by the classroom teacher. Students need to be immersed in a balanced literacy program in their regular classrooms that includes appropriately leveled guided reading sessions in order for their new skills to be firmly established. 5th Block teachers communicate frequently with classroom teachers and provide a written report of the students' progress at the end of the session. Progress is reviewed in Grade 2. Most students have gained the necessary literacy skills to participate in regular classroom activities, and for the most part, are able to continue their literacy development in a more typical manner. Recommendations for further support are suggested for those few students who continue to experience difficulties.

Students become more capable in the regular class setting over the course of the 5th Block session, and later. The most frequent observation by classroom teachers is that of students' increased confidence level and their willingness and ability to participate in classroom literacy activities. Though there is *not* a writing component in the program, the spill-over effect of the work done is evident in the students' ability to apply this knowledge in their writing. When students are selected properly and make significant gains, they are able to easily transition back to their classrooms and participate fully at grade level.

Benefits to parents and families

Parents' positive response to the program is multi-fold:

- their concern over a reading problem has been addressed and resolved,
- the program is offered at the school and during school hours,
- they, too, see improvement in the reading skills of their children,
- the associated stress at home is relieved, and
- many 5th Block students go on to instruct younger siblings and other older family members on reading strategies.

Students often express sadness when their 5th Block session ends. For many, it is the first school setting in which they have experienced success. They had difficulties beginning to learn to read and were aware that other children could read well and they could not. In the 5th Block classroom, they are taught at their level, the other children in the group are at their level, and the books are at their level. The challenges given to the students are attainable. Children have said that going to 5th Block is a "fun experience" because of the activities, but this relates directly to the fact that they can be successful. Students become competent, confident, and they feel good about themselves.

Professional Development within the 5th Block Program

An integral part of the program is the professional development provided to 5th Block teachers. Every teacher is assigned a mentor/coach. These mentors also teach a class of their own. Mentors visit on a regular basis to observe, model, dialogue with, and share ideas on instructional strategies, student selection and student progress; and visit other 5th Block teachers to observe, dialogue and share in a small group setting. Large group meetings are held approximately every second month to share information and participate in activities to deepen their understanding of how children learn to read and how teachers can assist and support literacy development in beginning readers. 5th Block teacher are then able to share instructional strategies and literacy knowledge with other primary teachers in their home schools.

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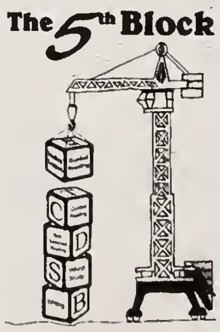

ERRORLESS CLASSROOM MANAGEMENT: A PROACTIVE APPROACH TO BEHAVIOURAL CHALLENGES IN THE CLASSROOM

Joseph M. Ducharme

Although managing student problem behaviour is one of the greatest challenges facing teachers, sophisticated training in classroom management is often not substantially addressed in the curriculum of teacher training programs, leaving teachers to fend for themselves in dealing with children who disrupt the classroom or fail to apply themselves to academic tasks. Under such circumstances, teachers often resort to "reactive" approaches—techniques that immediately follow the problem response and are geared towards decreasing these responses. The most commonly used of these techniques are reprimands and various forms of timeout (e.g., Van Acker, Grant, & Henry, 1996; Zabel, 1986).

Reactive classroom management

Reactive strategies may have some short-term benefits, but there are several concerns with long-term use, including:

- These approaches are geared toward stopping the problem behaviour but, when used in isolation, do not teach students strategies for managing challenging situations more effectively (Witt, VanDerHeyden, & Gilbertson, 2004). For this reason, reactive approaches are unlikely to lead to long-term reductions in problem behaviour.
- The use of reactive consequences is particularly concerning with the recognition that conduct problems are often associated with a range of psycho-social stressors (e.g., poverty, family violence). For these children, problem responses may serve as a form of adaptation to their challenging life circumstances. Punishing away such responses with reactive approaches may stifle the child's only means of coping with a distressing and unpredictable environment (Ducharme & Harris, 2005).

Errorless classroom management

Recent research evidence suggests that use of proactive approaches, those focused on positive teacher/student interactions and prevention rather than suppression of problem responses, are most likely to lead to long-term improvements in student pro-social behaviour. Errorless Classroom Management (ECM) is one such approach, so named because it is underpinned by the same principles as errorless learning, a teaching strategy that results in many fewer student errors than more traditional trial and error teaching approaches. ECM is also derived from Errorless Remediation strategies, home-based clinical approaches to treatment of severe problem behaviour (Ducharme, Atkinson & Poulton, 2000; Ducharme & Drain, 2004).

ECM focuses on building a child's tolerance to classroom conditions associated with problem behaviour rather than on the suppression of such behaviours, and therefore minimizes the use of punishment as a consequence for conduct difficulties. The teacher is trained in strategies for scaffolding students to success in their cooperative, academic, and social efforts, decreasing the aversiveness of challenging tasks and gradually introducing more demanding conditions to the children while reinforcing them to manage increasing challenge.

ECM: Three categories of procedures

Moderating behaviour for student success

Students with conduct difficulties often demonstrate problem behaviour because they do not have the skills to handle difficult classroom circumstances, such as completing demanding academic seatwork or doing group work. Given that these situations typically lead students to academic and social failures, they may act out to distract themselves from or to escape the unpleasantness of the task (Ducharme & Harris, 2005). Moderating approaches are techniques to support children early on so they are more likely to succeed with difficult classroom situations and less likely to find them aversive. They are therefore much less likely to respond with problem behaviour.

Two categories of strategies can be used to moderate problem behaviour in the classroom: antecedent and ecological approaches (including rapport).

Antecedent approaches

Most classroom behaviour problems occur in the presence of specific events that occur immediately before the behaviour, such as the presentation of academic demands or teacher requests to terminate pleasant activities. The behaviour occurs under these circumstances because it is functional (Larson & Maag, 1998), that is, it results in a desired outcome for the child in these situations. Such problem responses are often attempts to escape the aversiveness of a situation or to gain access to more pleasant conditions.

Just as some antecedent classroom conditions are associated with problem behaviour, some are likely to lead to prosocial responding, particularly those that increase student success and other positive outcomes. There are several antecedent procedures that can be used to increase the likelihood of desired behaviour.

Scaffolding for success

One of the most effective classroom moderating approaches involves scaffolding students, through the use of prompt support and one-on-one attention, to increase the likelihood of success with a challenging task or situation. Such supported successes provide the opportunity for praise and acknowledgement that will build student self-efficacy and increase the future probability of task completion (Ducharme, Lucas & Pontes, 1994).

Reduced demand

For students who find academics aversive due to their inability to master the content, teachers should consider reducing the level of difficulty of the material presented to increase the odds of the child's success. Similarly, work duration can be shortened initially to a level that the child can tolerate easily without losing focus or demonstrating disruptive behaviour (Ducharme & Harris, 2005). Although teachers may be concerned that they are not meeting curriculum requirements for their students with such strategies, these techniques are required only for a short time (see also *Increasing demand systematically*, below).

High probability requests

A useful strategy for gaining cooperation from children who are oppositional in the classroom is to provide requests that are likely to yield compliant responses. When teachers ask students to do things that they find enjoyable and then provide them with praise for compliance with these high probability requests, the oppositional student will begin to experience cooperative successes and be more motivated to work with others in the future (Ducharme & DiAdamo, 2005).

Engaging content

Teachers should embed daily curriculum requirements into a context of teaching materials and instructional formats that the child finds interesting and enjoyable. Children are much more inclined to focus on their work when it includes, for example, reference to a favourite basketball team, or other popular topics.

Priming

When students are provided with preparatory information about upcoming circumstances that they find difficult to manage (e.g., termination of an enjoyable art activity), they are more likely to be ready for the situation when it occurs, and less likely to respond disruptively.

Ecological approaches and rapport

Many factors that are not readily observable in the classroom can have a dramatic impact on the behaviour of students. Youngsters may suffer through difficult stressors such as abuse, family violence, schoolyard bullying, divorce, or any number of conditions that can have a negative emotional impact. They may also experience physiological challenges such as hunger, fatigue, allergies, or medical conditions that can create significant physical discomfort and make the typical challenges of the classroom much more daunting. Students may use disruptive behaviour as a means of escaping or avoiding negative thoughts and emotions, as well as the aversiveness of the tasks they are asked to perform in this distressed state (Hayes, Wilson, Gifford & Follette, 1996).

Ecological variables can be frustrating for teachers because, typically, the stressors are not observable and do not occur in proximity with the behaviour that they influence. The significance of these factors is often only suspected due to patterns in problem behaviour; confirmation may require candid conversation with the child, parents, or others involved in the child's life.

If teachers are able to establish the presence of physiological stressors, they can sometimes address them with simple strategies, such as; a breakfast program for children who are not getting adequate nutrition, discussion with parents about scheduling changes to deal with the child's sleepiness in the classroom, and medical intervention for children with allergies or other physical conditions leading to pain or discomfort. If such concerns cannot be confirmed through discussion with the child or parents, however, they are unlikely to be resolved. Similarly, stressors that affect the child emotionally, such as problematic home situations, can be difficult or impossible for the teacher to remedy unless the child is forthcoming about these challenges.

Often the best strategy available for teachers to manage ecological conditions involves development of a warm and caring relationship with their students. Recent research shows the positive effects of responsive teacher/student interactions (Pianta, 1999). Such relationships can serve several purposes:

- create a comfortable atmosphere that enables the student to share difficulties with the teacher,
- offer a foundation of support for the child that provides additional scaffolding for the curriculum requirements that must be addressed by the teacher, and
- increase the probability of child cooperation with teacher requirements.

There may be no simpler way for teachers to moderate classroom problem behaviour than to spend a short time each day making warm and playful conversational contact with students.

Reinforcing successful responses

Once cooperative, on-task, and other pro-social behaviours have been encouraged and problem responses reduced using antecedent and ecological strategies, the teacher needs to ensure that the desirable child responses become that child's mainstay for classroom performance. The use of teacher praise, acknowledgement, and other forms of commendation can be powerful classroom management strategies when used as reinforcement for desired responses that have been made more commonplace through use of moderating approaches. These reinforcement strategies are optimally potent with teachers who have made efforts to build rapport with the child.

Note, however, that some children require other types of rewards to strengthen pro-social behaviour repertoires. Classroom point systems, token economies, individual reward charts, and other reward systems can be used to provide the child with access to things they are willing to work for, such as extra computer time or being classroom helper for the day. These techniques can be easily embedded into daily classroom functioning to provide reinforcement of pro-social classroom response.

Certain key skills, including communication skills, compliance and rule-following, on-task skills, and social interaction, produce particularly powerful and preventive effects when developed and reinforced intensively by teachers. Focused attention in these areas will likely produce the broadest positive effects in the classroom.

Increasing demand systematically

Although the moderated conditions described above greatly enhance the ability of children to respond pro-socially to classroom circumstances and accomplish required tasks, the level of support required for these approaches is often too high to be sustained by the teacher for long periods of time. Further, children whose behaviour requires extensive scaffolding by teachers are unlikely to maintain their pro-social repertoire into the future when such supports are no longer available. Thus, for every behaviour or skill they have prompted and reinforced, teachers need to gradually return support to lower levels similar to those required by students without behavioural challenges.

The primary strategies for moving from early to later stages of ECM involve alteration of antecedent conditions, especially reducing scaffolding, increasing demand, and increasing challenging requests.

Reducing scaffolding

With ECM, teachers gradually reduce the amount of one-on-one and prompt assistance while maintaining child success at the level achieved when supports were most intensive. Contingent on each pro-social student response that occurs, students receive praise or other forms of reinforcement from the teacher for managing the decreasing support. The most important consideration for the teacher is to move errorlessly, that is, at a slow enough pace that problem behaviour does not return.

Increasing demand

Over the course of the semester, moderated demand levels and work durations must be increased. Because the reinforcement occurs following successful responding with this approach, however, children are typically willing and highly motivated to demonstrate to the teacher that they can handle increasing challenges and greater independence. Again, it is important to ensure that increases in demand occur slowly enough that the problem behaviour does not return to earlier levels.

Increasing challenging requests

As noted earlier, teacher requests that are highly likely to yield compliance (e.g., "turn on the computer," "hand out the papers for me") can help moderate problem behaviour in the classroom. Teachers can intersperse these requests among regular classroom requests they routinely deliver. Over time, the number of high probability requests can be gradually reduced at a pace that encourages the child to continue complying with regular classroom requests (Ducharme & Worling, 1994). Reinforcement following compliant responses is a necessary component of this approach.

Putting it all together

The above strategies can be employed efficiently by teachers who remain in touch with their students and aware of most things that go on in the classroom. By moving around the classroom frequently—prompting a child to task here, praising several students for working quietly over there, having a pleasant chat at one moment and asking a child to help collect assignments at another—the effective teacher can use ECM to greatly reduce the need for reactive procedures. As scaffolding is gradually faded, teachers will find that their students are much better able to apply themselves to their work and cooperate with their peers. Any extra work put in at the beginning of ECM will pay off large dividends later in the semester as former problem students begin to function with much less teacher attention and support.

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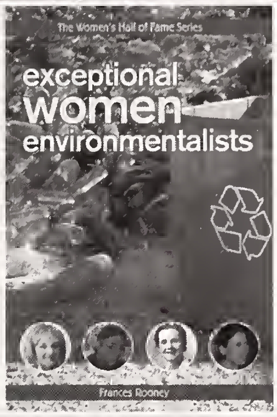
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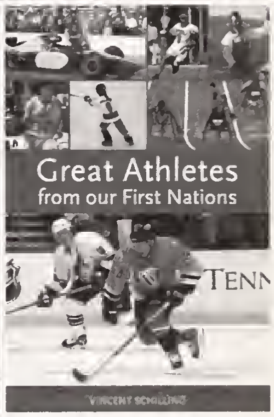

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PROMISING PRACTICES IN EDUCATION FOR STUDENTS WITH ADHD

Rosemary Tannock, Rhonda Martinussen

ADHD is medical term for individuals who exhibit a persistent, pervasive, impairing, and developmentally inappropriate pattern of inattention, impulsivity, and hyperactivity (American Psychiatric Association, 2000). It is a prevalent neurodevelopmental condition that occurs in approximately 5% of school-age children worldwide (Polanczyk et al., 2007) and in which both the symptoms and impairment tend to persist into adolescence and adulthood. Thus, elementary and high school teachers are likely to have at least one or two students with ADHD in the classroom.

Inattentive behaviour is a developmental risk factor for poor academic outcome

Children and adolescents with ADHD are at high risk for poor academic outcomes (Curry & Stabile, 2006; Frazier et al., 2007). Notably, it is the inattentive behavioural dimension, and not the hyperactive/impulsive behavioural dimension, that is associated with academic risk (Spira & Fischel, 2005). For example, inattentive behaviour in kindergarten children, but not hyperactive-impulsive behaviour, predicts poor reading outcomes in Grade 1 and also in Grade 5, independent of kindergarten reading-related skills and concurrent levels of hyperactivity/impulsivity (Dally, 2006; Rabiner & Coie, 2000). Inattentive behaviour in the classroom is also strongly associated with mathematics difficulties in elementary school children (Dobbs et al., 2006; Fuchs et al., 2005). Moreover, inattentive behaviour has been found to predict poor response to evidence-based reading and math instruction (Fuchs et al., 2005; Rabiner & Malone, 2004). Accordingly, the presence of even a few persistent symptoms of inattention in childhood is considered a developmental risk factor (Warner-Rogers et al., 2000).

Cognitive problems underpin both inattentive behaviour and poor academic outcome

Current theoretical and empirical work emphasizes that cognitive difficulties, and not poor attitude or laziness, underpin both inattentive behaviour and poor academic functioning (reviewed by Barkley, 1997; Castellanos & Tannock, 2002; Spira & Fischel, 2005). In particular, poor working memory, which is impaired in ADHD, is linked most closely with inattentive behaviour but not with hyperactivity/impulsivity (Lui & Tannock, 2007; Martinussen et al., 2005; Martinussen & Tannock, 2006). Working memory is a term used to refer to the ability to hold and manipulate information temporarily (for a few seconds only) in one's head, despite ongoing distractions such as conversation or other classroom activities (Baddeley, 2000). Adult research has shown that individuals with poor working memory capacity are more likely than those with good working memory to have difficulties sustaining task-relevant thought and behaviour in the presence of competing mental and environmental distracters, and are more prone to mind-wandering and other off-task behaviour (e.g., Kane et al., 2007).

Working memory is prerequisite for performing complex tasks such as mental arithmetic, listening and reading comprehension, and reasoning, and predicts future academic achievement in literacy, mathematics, and science (reviewed by Alloway, 2006). For example, working memory predicts growth in reading fluency and comprehension, and subsequent academic achievement in mathematics and science as well as in literacy (St. Clair-Thomson & Gathercole, 2006; Swanson & Jerman, 2007).

Educational prevention and intervention approaches should address both cognitive and attention problems

Inattentive behaviour, poor working memory and poor academic achievement are interrelated and constitute a risk triad. Thus, intervention that aims either to reduce inattentive behaviour or to improve cognitive function would be experted to enhance the children's academic outcomes. Two of the main approaches used to improve inattention are medical treatment (e.g., medication, such as Ritalin) and psy-

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chological intervention (e.g., behaviour therapy; classroom behavioural interventions). Although these approaches have robust and positive effects on behavioural variables such as inattentive and disruptive behaviour within classroom settings, there is no robust evidence that these intervention approaches improve academic outcomes for students with ADHD (reviewed by Raggi & Chronis). Moreover, inattentive behaviour in the classroom, as rated by teachers, predicts a poor response to evidence-based educational interventions that aim to improve reading or math outcomes (Fuchs et al., 2005; Rabiner & Malone, 2004).

Educators need to consider attention skills and working memory abilities in their instructional practices to enhance children's academic attainment (see Martinussen et al., 2006, and www.teachadhd.ca for in-depth discussion of this topic). There is emergent evidence of two effective intervention approaches that show promising effects for both behavioural and academic outcomes in students with ADHD:

1. student-focused approaches that aim to enhance either attention skills or working memory; and
2. sustained professional development programs for teachers that aim to increase their awareness and understanding of ADHD and their use of instructional strategies found to be effective for students with ADHD.

Promising instructional practices: Child-focused skill training

A small but growing body of research shows that direct intervention, involving intensive and progressive taxing and training of attention skills (Attention Process Training: APT) results in improvements in cognitive and/or academic attainment as well as in inattentive behaviour (e.g., Kerns et al., 1999; Shalev et al., 2007).

The premise of this approach, which is based upon cognitive models of attention and stems from the cognitive rehabilitation literature, is that attentional abilities can be improved by providing structured opportunities for exercising various aspects of attention (e.g., sustained, selective, alternating, and divided). APT materials consist of a set of hierarchically organized and structured paper-and-pencil or computer tasks, which target the various aspects of attention that the child must practice. The tasks are designed to enhance understanding and retention of information or instructions, categorization of visual and auditory materials by verbal labels, switching tasks flexibly, and maintaining focus on target information despite auditory and visual distracters. Corrective feedback is given and students chart their own progress in speed and accuracy. This is not a "quick-fix" approach: rather, children are required to practice the attention tasks for about 30 to 60 minutes a session, several times a week for 8 to 24 weeks (Penkman, 2004; Shalev et al., 2007). Notably, this approach has shown promising results for students with childhood cancer, traumatic brain injury, and ADHD (reviewed by Penkman, 2004). Also, one study showed that prior and individualized attention training with the APT materials potentiated the effects of writing instruction for children with dyslexia (Chenault et al., 2006).

Another type of direct intervention, or process-specific approach, involves computerized training of working memory (Klingberg et al., 2005). Intensive and progressive challenge and practice of working memory skills not only enhances working memory capacity, but also results in training-related changes in brain activity, with training effects generalizing to behavioural ratings of inattention, tests of attention, reasoning, and problem-solving in healthy adults, as well as in children with ADHD (Klingberg et al., 2005).

Promising instructional practices: Teacher professional development

Teacher-focused approaches aim to enhance teachers' awareness and understanding of ADHD (e.g., Sayal et al., 2006; Tymms & Merrell, 2004) and/or their use of effective instructional approaches as well as effective behaviour management techniques. For example, findings from a large-scale study in the United Kingdom demonstrate that simply screening and "labelling" children who meet diagnostic criteria for ADHD has no effect on child outcomes. By contrast, providing teachers with an information book on ADHD, effective behavioural management strategies, and effective instructional practices was found to improve the children's behaviour, attitudes toward school, and their reading, as well as improving teachers' self-reported quality of life (Tymms & Merrell, 2004).

Provision of comprehensive training and in-depth consultation to teachers about ADHD (i.e., targeting characteristics, instructional and/or behaviour management strategies) has also been found to have positive effects on students with ADHD including reductions in their primary symptoms, antisocial behaviour, teacher-student relationships, and academic gains (DuPaul et al., 2006; Miranda et al., 2002; Owens et al., 2005). Also, teachers report improvements in knowledge and reduction in stress regarding working with students with ADHD (Miranda et al., 2002). Even a brief but focused professional development program on effective use of instructional language has been found to be effective in reducing children's inattentive behaviour and enhancing their academic attainment (Rowe, Pollard & Rowe, 2005).

ATTENTION PROCESS TRAINING

Premise

Attention Process Training (APT) is based on the premise that repeated and intensive practice of tasks that are designed to progressively tax specific aspects of attention can increase the ability to control attention, because practice produces changes in the efficiency of the underlying attentional networks of the brain.

Materials

APT materials are designed to be engaging and include visual and auditory stimuli. Materials are colourful and tasks focus on familiar concepts, such as features of people (e.g., hair colour, clothing, gender), family relationships (siblings, parents, grandparents), household objects and characteristics (purpose of rooms, objects in those types of rooms); as well as common concepts such as relative size, counting, similarities and differences. Task difficulty is progressively increased as the child attains criterion performance.

Tasks

APT tasks are designed to tap the following components:

- ***Sustained attention***—the ability to maintain concentration during continuous repetitive or effortful activity.
  Examples of tasks are: sorting cards into categories (by single features, such as card colour, hair colour); searching for designated objects in pictures of a house; listening to an audiotape and pressing a buzzer when specific words or word patterns are heard.
- ***Selective attention***—the ability to attend to task-relevant information and block out irrelevant stimuli.
  Individuals who have problems at this level are easily distracted from the appointed task. Tasks are similar to those used for training sustained attention but the child must complete the task with distracting stimuli superimposed (e.g., background noise).
- ***Alternating attention***—the ability to switch rapidly from one task to another.
  Tasks involve sorting cards by one criterion, then switching criteria as indicated by the trainer, or buzzing to one type of word, then changing to buzzing for another type when instructed by the trainer.
- ***Divided attention***—the ability to multi-task, such as taking notes while listening to a lecture, or holding thoughts in mind while discussing a point or writing an essay.
  Tasks involve sorting cards on the basis of a specified criterion, but with an additional rule (e.g., sort cards by family, put boys face down, or sorting cards while also monitoring audiotape and buzzing for target sounds or words).

Summary and Commentary

Persistent and marked inattention in childhood is a developmental risk factor for poor academic outcome and also predicts poor response to educational intervention. Thus it is essential that educators learn to recognize behavioural indicators of inattention in the classroom and to develop both child-focused (e.g., self-monitoring intervention of behaviour and engagement; targeted academic skills/strategy instruction) and contextual strategies (e.g., instructional supports and approaches that maximize student engagement) for promoting these students' academic success. Interventions that monitor and target both the behavioural symptoms of inattention and underlying cognitive difficulties show efficacy in that they improve both the academic and behavioural outcomes of inattentive students.

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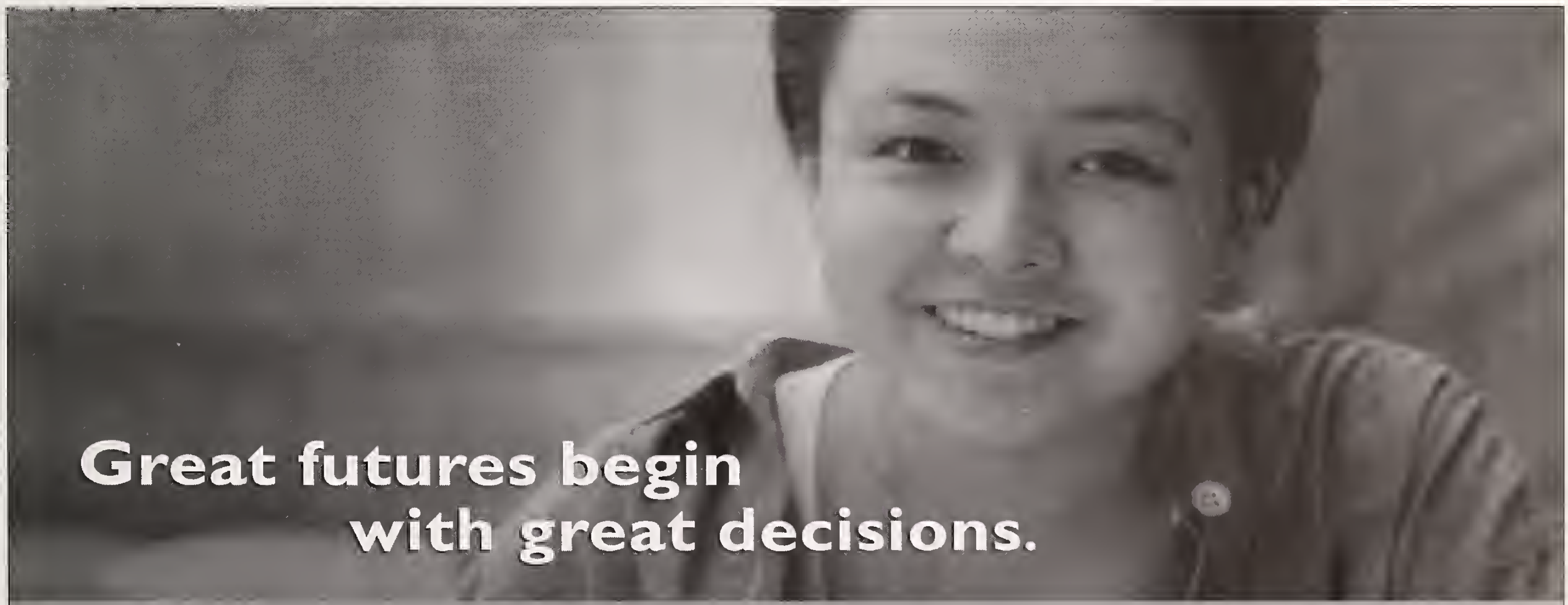

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CULTIVATING GIFTEDNESS: HOW PARENTS AND TEACHERS CAN SUPPORT EXCEPTIONAL LEARNERS

Joanne Foster

There is no single gifted child profile. Each child and situation is unique. Recognizing giftedness is a matter of identifying exceptional learning needs at a particular point in time—and then, of course, providing the right kinds of opportunities for the child's optimal development.

Assessing a child's abilities should include several different measures. This might include dynamic classroom assessment (which involves figuring out what a child knows at the beginning of any unit of study and then embarking on a cycle of assess—teach—assess—teach), standardized achievement tests, intelligence tests, and student portfolios (records of work or other outside learning activities).

There are many misconceptions about gifted learners—who they are, how they act, and what they can accomplish. For example, it may be assumed that all gifted learners are avid readers, high achievers, that they demonstrate excellent study skills, and that these qualities are easy for teachers to spot. Not necessarily so—children's developmental pathways are different and unpredictable. Giftedness is an individual differences phenomenon. The boy who always responds excitedly in class may or may not be gifted. The girl at the back of the room who rarely speaks up may or may not be gifted.

Gifted learners are not all alike. They have different interests, experiences, learning preferences, and ways of functioning. Every person plays an active role in creating his or her own intelligence and there are all kinds of influences along the way.

Nevertheless, people often ask me what "gifted" means. Here is a workable definition: *A gifted learner is one who is exceptionally capable for his or her age or grade in one or more subject areas, and needs special programming for happy and productive engagement in learning.*

This definition is practical because it ties identification to educational programming.

Is there a stigma associated with being gifted?

When a child is labeled as gifted, they may feel like they have been given a flower, but one with thorns. The label comes with positive and negative effects.

Labels may carry problematic connotations that can be hard for children to reconcile. Moreover, labeling certain children as gifted implies that other children are *not*, or that they lack special abilities or gifts.

The gifted categorization sometimes evokes teasing or rejection from peers, conflicting expectations from parents and teachers, and concerns about developmental issues. Some children may think that because they have been identified as having heightened abilities they don't have to put forth much effort, whereas others may worry that they won't be able to keep up. There can be misinformation and controversy about what the label means. On the other hand, it is a validation of a child's abilities, and is sometimes the necessary ticket for appropriate programming and/or special educational services. In general terms, it would be best for a child to be in a learning environment that is appropriately challenging *without* having to have the gifted label.

It would be ideal if "being gifted" was understood simply as the identification of exceptional learning needs. This way of looking at it removes some of the elitism, mystery, and confusion often associated with the label, and much of the stigma frequently attached to it and to gifted education. Instead of labeling children, an effective alternative is to label educational services. Schools should offer a variety of options to all students who are interested in and capable of taking advantage of them.

How do you test for giftedness?

Any testing process should be an ongoing process and not be based on a single test. There should be regular evaluation of children's abilities as they mature. It should be diagnostic (that is, indicating areas where children are very capable and areas where they are less so), and it should specify programming implications. The exceptional learning needs (not the child) should be identified as gifted.

The topic of IQ testing continues to be controversial. Although there are alterative methods to identify academic and other needs, IQ tests can provide valuable information about a child's learning styles and areas of cognitive strength and weakness. This information can be used by teachers for developing programs and planning adaptive instruction. Remember: The value of any test lies in its interpretation, and in understandings of test-related issues.

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What programming is best for exceptional learning needs?

Gifted programming can occur in specialized or regular classes, enrichment programs, cluster groups, at home, or in other learning environments. Wherever it happens, it should incorporate choice and a range of learning options.

The process of matching a child's needs, interests, and abilities varies from one person to the next. Sometimes a gifted class provides the right setting and mix of learning activities. A regular classroom works well when teachers are able to differentiate programming and target instruction appropriately. Pull-out enrichment programs or flexible groupings may be the best option for some children. Acceleration is another alternative.

Individual development cannot be categorized, there is no set path leading to guaranteed success for every child.

The best approach for working with high-ability learners is to provide a multitude of relevant educational opportunities, and to take into account a variety of learning styles and preferences. Children can also be encouraged to become actively involved in planning their learning experiences. This enables them to take responsibility, to set reasonable standards for themselves, and to feel good about their accomplishments.

How do gifted children achieve balance in their lives?

Some children experience difficulty managing the social and academic aspects of their lives; others experience no trouble whatsoever. Most gifted learners are at least as socially and emotionally competent as others their age, although their levels of cognitive functioning may be more highly developed.

Parents and teachers must be attentive to what's happening in a child's life and offer guidance, reassurance, and support, keeping in mind that these children are, indeed, still children.

The sense of being "different" is a prevalent problem for exceptional learners, including those who are gifted. It can be particularly painful at adolescence, a time when identity and social acceptance issues are heightened. Boredom and frustration are other concerns. These often result from a poor fit between children's learning needs and programming provisions. Fear of failure, fear of too much success, and self-confidence issues can also pose problems.

Parents and teachers should look at the whole child, ensure that the school program is adapted to the individual, and foster emotional and social intelligence in the context of daily activities. Adults should seek information about giftedness from multiple sources. Most importantly, parents should facilitate children's play because it lays a foundation for learning how to get along with others.

When children's difficulties compromise their well-being it may be prudent to enlist the help of a counseling professional. Resources are available from the school administrative team and the child's family doctor.

What if you don't put a gifted child in special programming?

A school is only as good as its teachers and administrators, the communication network it sets up with parents and the community, and the resources and materials it provides for inquiry-based learning. There are countless educators in "regular classrooms" who offer exciting and relevant educational experiences for gifted learners. These teachers differentiate programs effectively and creatively, they motivate students, and they empower children to be happy, life-long learners, both in school and out.

Bright, capable children can and certainly do fare very well in programs that are not specifically designated as gifted. If a child is being appropriately challenged and feels happy about life and learning then that is well and good. Moreover, there are many ways to provide learning opportunities beyond the classroom. Examples include: mentorships; community service partnerships; extracurricular programs; real and virtual travel; career exploration; and educational offerings at places such as galleries, theatres, music venues, and museums.

Will gifted education help students prepare for university?

Gifted programs often provide students with motivating and real-world learning options; a focus on fine-tuning study skills; the seeds to cultivate inquiry; and skills to adopt flexible approaches to learning and teaching—all excellent preparation for university. And, we know that all regular school programs strive to provide these same learning environments.

Parents and teachers can help prepare children for post-secondary education by ensuring that they feel safe, productive, and have a healthy balance in their lives. How to accomplish this? Offer children choice within an abundance of suitable learning opportunities, celebrate their day-to-day accomplishments, and provide them with guidance, love, and a nurturing environment throughout their school years. That's the best readiness for university, and for life itself.

FURTHER READING

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- *Being Smart about Gifted Children: A Guidebook for Parents and Educators*. Matthews, D.J. & Foster, J.F. (2005). Scottsdale, AZ: Great Potential Press. www.beingsmart.ca.
- *Comprehensive Curriculum for Gifted Learners (3rd Edition)*. Van Tassel-Baska, J. & Stambaugh, T. (2006). Boston, MA: Pearson Education, Inc.
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- *The Social and Emotional Lives of Gifted Kids: Understanding and Guiding their Development*. Cross, T.L. (2005). Waco, TX: Prufrock Press, Inc.

JOURNALS:

Gifted and Talented International
Gifted Child Quarterly
Gifted Child Today
Journal for the Education of the Gifted
Journal of Secondary Gifted Education
Parenting for High Potential
Roeper Review – A Journal on Gifted Education
Teaching for High Potential

WEB SITES:

www.beingsmart.ca (Gifted Related Links and Resources)
www.edgo.ca (Educators of the Gifted Organization)
www.hoagiesgifted.org (Gifted resources)
www.nagc.org (National Association for Gifted Children)

PROMISING PRACTICES FOR UNIVERSITY STUDENTS WITH LEARNING DISABILITIES AND ADHD: SPECIFIC FOCUS ON THE UNIVERSITY OF TORONTO

Mary Damianakis

There has been an increase in the number of students with disabilities enrolling in colleges and universities in North America in recent years (Henderson, 2001; National Center for Education Statistics, 2003; The Ontario Human Rights Commission, 2006). In Canada, the obligation to provide accommodation is embedded in human rights legislation that forbids discrimination and promotes equity for all individuals, including those with learning disabilities—*Canadian Charter of Rights and Freedoms; Ontario Human Rights Code* (Learning Disabilities Association of Canada [LDAC], 2007; The Ontario Human Rights Commission, 2006). Educational institutions have a legal and ethical responsibility to provide accommodation to students diagnosed with a learning disability, and to ensure equal opportunity and access to education at all levels (LDAC, 2007). Consistent with this policy, the University of Toronto has issued the following "statement of commitment regarding persons with disabilities":

> *... the University will strive to provide support for, and facilitate the accommodation of individuals with disabilities so that all may share the same level of access to opportunities, participate in the full range of activities that the University offers, and achieve their full potential as members of the University community. The University will work to eliminate or minimize the adverse effects of barriers, including physical, environmental, attitudinal, communication and technological barriers, that may prevent the full participation of individuals with disabilities in the University community. (University of Toronto, Governing Council, 2004)*

Other universities in Canada have similar statements (see Access services at Canadian universities: www.mcgill.ca/osd/links). Based on 1999 findings, 75% of post-secondary institutions in Canada have formal policies for students with disabilities, although there are wide variations in content and practices (The Ontario Human Rights Commission, 2006).

It is estimated that up to half of all students with disabilities are students with learning disabilities (Mason & Mason, 2005). Individuals with learning disabilities (LD) are considered to be a heterogeneous group with diverse strengths and weaknesses. Comorbidity of various disorders with learning disabilities has been shown to be high; 30%–40% of individuals with LD also have Attention Deficit Hyperactivity Disorder (ADHD) (LDAC, 2007). Multiple challenges with the assessment of LD and ADHD in adults have been noted in the literature and are beyond the scope of this paper; they include varied conceptualizations of LD, the lack of clear diagnostic criteria, and cultural bias surrounding the assessment of culturally diverse students (American Psychological Association, 2003; Gregg, Coleman, Davis, Lindstrom, & Hartwig, 2006).

Providing accessible services

Although research on LD/ADHD in adult populations is limited, the prevalence of these conditions is increasingly being documented in college samples (Mason & Mason, 2005; Weyandt & DuPaul, 2006). For example, based on a literature review of 23 studies on ADHD in college students (published between 1985 and 2004), prevalence reports showed an increase in the number of students with disabilities, estimating that approximately 25% of students with disabilities receive services for ADHD (Weyandt & DuPaul, 2006). Furthermore, students with ADHD have been shown to be at an increased risk for difficulties related to academic performance (e.g., lower grade point average, difficulty fulfilling course requirements, less likely to graduate from college), compared to non-ADHD peers (Weyandt & DuPaul, 2006).

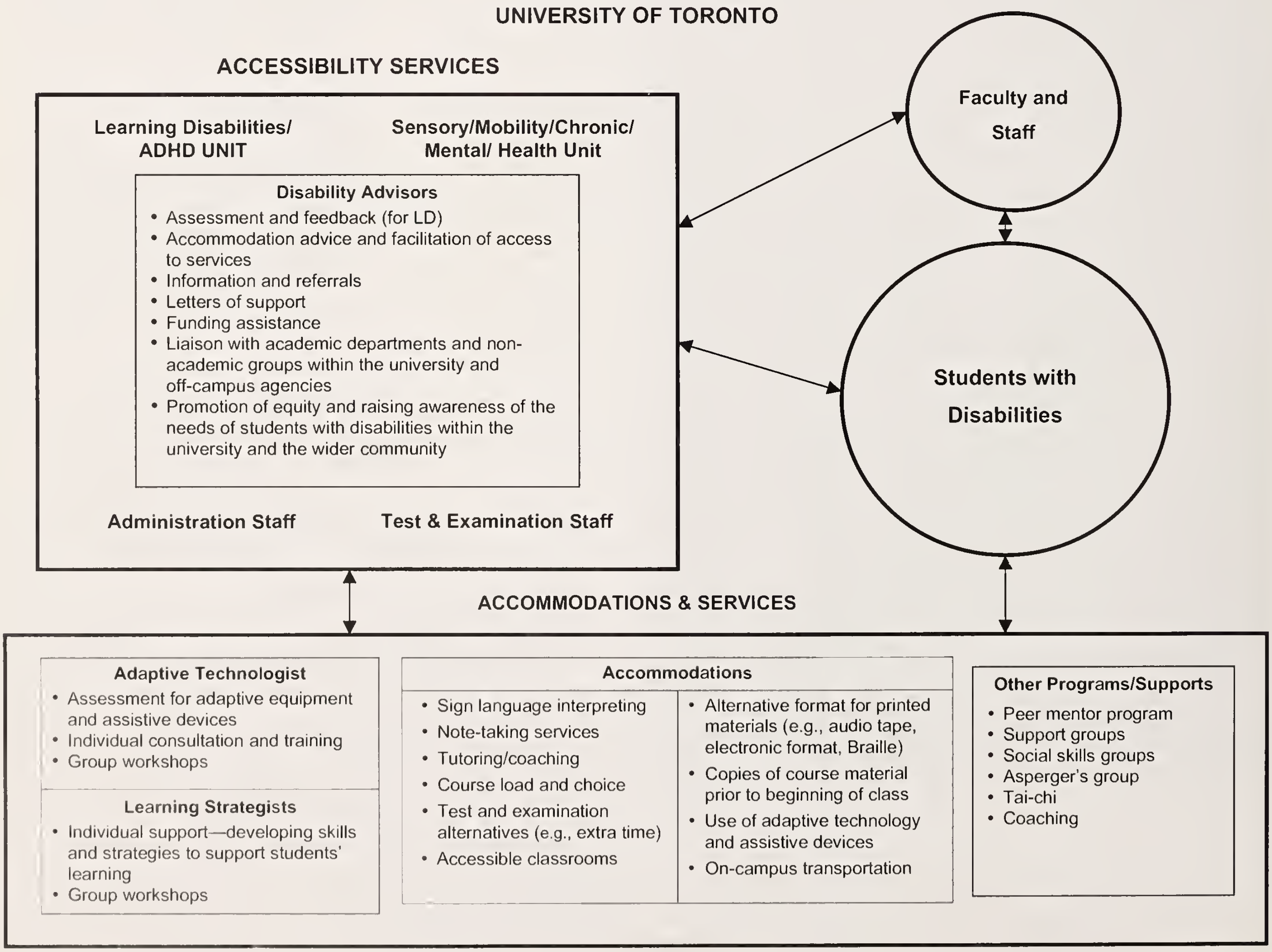
The transition from high school to post-secondary education can be a challenging time for students under the best of circumstances. For students with disabilities, the challenges may be compounded by social and physical barriers to access, along with questions and issues related to self-advocacy and disclosure of their disability (Reed, Lewis, & Lund-Lucas, 2006). At the University of Toronto (UofT), Accessibility Services (AS) offices are located on all three UofT campuses to assist students with disabilities through this transition, and to facilitate their inclusion in the full range of university programs and activities (University of Toronto, Accessibility Services, 2006–2007). Students with a documented disability (e.g., physical, mental, sensory, LD/ADHD, or chronic health) access AS voluntarily, seeking additional support toward achieving their academic goals. According to 2005–06 statistics, over 1,500 students received services and support from Accessibility Services on the St. George campus; this represents a 16% increase from the previous year (AS Annual Report, 2005–2006). Among these students, 21% sought services for more than one disability, 36% had a diagnosed learning disability, and 8% had ADHD.

Accessibility Services is divided into two units:

1. Learning Disabilities/ADHD Unit, and
2. Sensory/Mobility/Chronic/Mental/Health Unit.

Within the LD/ADHD Unit, students with learning disabilities and/or ADHD consult disability advisors regarding a wide range of needs, including LD assessment, accommodation advice, information and referrals, letters of support, and funding assistance. The advisors work collaboratively with students, emphasizing their strengths, promoting academic and self-advocacy skills, and facilitating access to a wide range of accommodations (University of Toronto, 2006–2007) (Figure 1). Accommodations for students with LD/ADHD may include extended time for tests/exams, modifications to course requirements, tape recording of lectures, the assistance of note-takers, tutors, and technology. The

FIGURE 1
Accessibility Services for Students with Disabilities at the University of Toronto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ACCESSIBILITY SERVICES
Learning Disabilities/ ADHD UNIT
Sensory/Mobility/Chronic/ Mental/ Health Unit
Disability Advisors
• Assessment and feedback (for LD)
• Accommodation advice and facilitation of access to services
• Information and referrals
• Letters of support
• Funding assistance
• Liaison with academic departments and non-academic groups within the university and off-campus agencies
• Promotion of equity and raising awareness of the needs of students with disabilities within the university and the wider community
Administration Staff
Test & Examination Staff
Faculty and Staff
Students with Disabilities
ACCOMMODATIONS & SERVICES
Adaptive Technologist
• Assessment for adaptive equipment and assistive devices
• Individual consultation and training
• Group workshops
Learning Strategists
• Individual support—developing skills and strategies to support students' learning
• Group workshops
Accommodations
• Sign language interpreting
• Note-taking services
• Tutoring/coaching
• Course load and choice
• Test and examination alternatives (e.g., extra time)
• Accessible classrooms
• Alternative format for printed materials (e.g., audio tape, electronic format, Braille)
• Copies of course material prior to beginning of class
• Use of adaptive technology and assistive devices
• On-campus transportation
Other Programs/Supports
• Peer mentor program
• Support groups
• Social skills groups
• Asperger's group
• Tai-chi
• Coaching

advisors may refer students to a learning strategist or adaptive technologist for further support around developing strategies and using assistive devices to compensate for their difficulties. The aim is to reduce barriers to equal access and enhance academic success and meaningful participation in a full range of campus activities.

Scott (2002) has highlighted the importance of individualizing accommodations on the basis of multiple factors, taking into account the interaction of personal, social, and environmental factors (e.g., psychological assessments, individual strengths and weaknesses, instructional materials and methods, program requirements, and social attitudes/barriers):

> *... central to the provision of services for students with learning disabilities is the understanding that nondiscrimination comprises more than a menu of services. It is a dynamic process of actively considering varying individuals' disability-related needs within the context of the specific postsecondary setting. (p. 296)*

Consistent with this philosophy, the mandate of AS acknowledges the importance of personal and systemic levels of intervention. Thus, a holistic model is used that extends beyond the level of the classroom to include family services, career planning, counselling, relaxation, and social networks (e.g., social skills groups, Tai-chi, coaching, and Asperger's group). The AS offices also collaborate with other departments on campus and the wider community, raising awareness of the needs of students with disabilities, while working toward the "promotion of equity and justice within the university and recognition of the diversity of the university community" (University of Toronto, Student Affairs, 2007).

What is promising about practices in higher education is that services are available that provide support to students with disabilities on multiple levels and promote equitable access to education; these services are clearly being utilized with increasing frequency. Further research is needed to explore the impact of services on student outcomes and the complexity of factors (e.g., individual, environmental, social, political) that shape the experiences of students with disabilities in higher education.

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INTERNET RESOURCES RELATING TO TEACHING STUDENTS WITH SPECIAL EDUCATION NEEDS

John Morgan, Rhonda Martinussen

This annotated list of web sites provides information and resources related to the topics highlighted in this special *Orbit* issue, Promising Practices in Special Education. This is by no means a comprehensive list. Rather, our goal was to provide a snapshot of the different types of online resources that educators and parents may find useful. These web resources are primarily Canadian but we have also included relevant and useful web sites from international sources, such as the United States and the United Kingdom.

GENERAL INFORMATION

www.edu.gov.on.ca/eng/general/elemsec/speced/speced.html
Ontario Ministry of Education—Special Education

This web site's main topics include: overview, resolving identification or placement issues, policy direction, resource documents, and related information. There are also links to full ministry topics.

www.edu.gov.on.ca/eng/policyfunding/links.html
Ontario Ministry of Education

This web site lists all the provincial departments of education from across Canada.

www.bced.gov.bc.ca/specialed
British Columbia Ministry of Education—Special Education

This web site provides educators with a set of excellent resources on a wide range of topics relating to students with special education needs.

canadian.cec.sped.org
Canadian Council for Exceptional Children

CCEC advocates for students with disabilities and special challenges, and those with gifts and talents. This web site provides educators, support personnel and parents with resources, tools, and professional opportunities.

www.cec.sped.org//AM/Template.cfm?Section=Home
Council for Exceptional Children

This web site provides educators with information about a range of exceptionalities, along with information about how to support students in the classroom and beyond.

snow.utoronto.ca
Special Needs Ontario Window

This University of Toronto web site provides information and resources for working with students with special education needs.

www.interventioncentral.org
Intervention Central

This web site provides an abundance of information for supporting students with learning and/or behavioural difficulties. It also has a clear description of curriculum-based measurement tools and how to use them to monitor student progress.

iris.peabody.vanderbilt.edu/resources.html
IRIS Center for Training Enhancements, Vanderbilt University, funded by the Office of Special Education, U.S. Department of Education

This web site provides a diverse array of materials to support professional development related to special education.

www.k8accesscenter.org
The Access Center: Improving Outcomes for All Students K-8

This web site provides an excellent set of resources that support the use of different approaches to teaching students with special education needs.

www.york.ac.uk/res/wml/indexteachers.htm
Working memory and learning; University of York, United Kingdom

This web site provides information about working memory and its relationship to learning.

GIFTED

www3.bc.sympatico.ca/giftedcanada/index.html
Gifted Canada

This web site provides a range of resources and links relating to education of students who are gifted.

www.abcontario.ca
The Association for Bright Children of Ontario

This web site provides information and support to parents of bright and gifted children/adolescents in Ontario.

LEARNING DISABILITIES AND/OR LANGUAGE DISORDERS

www.ldao.ca
Learning Disabilities Association of Ontario

This web site provides parents and educators with information about learning disabilities and ways to support students in the classroom.

www.ldonline.org
LD Online

This web site provides a wealth of information about how to support students with various types of learning disabilities. It also provides information about working with students with ADHD.

www.ncld.org
National Center for Learning Disabilities (NCLD)

This web site provides information on a broad range of topics related to learning disabilities.

www.nationalreadingpanel.org/Publications/publications.htm
National Reading Panel (NPR)

This web site provides information about the synthesis of reading instruction conducted by the NPR in 2000. There are also links for parents and educators about promoting reading in young children.

www.readingonline.org
International Reading Association (IRA)

This is an online-only publication of the IRA. The focus of the publication is literacy practice and research in classrooms. Many articles address the needs of children with Learning Disabilities.

www.caslpa.ca
Canadian Association for Speech-Language Pathologists and Audiologists

This web site provides resources relating to the language development of preschool and school age children.

www.asha.org/public/speech/disorders/ChildSandL.htm
American Speech-Language Hearing Association

This part of the web site provides information about speech and language disorders in children and how to support students with speech and/or language disorders in school.

MENTAL HEALTH ISSUES— ADHD, ANXIETY, AND BEHAVIOUR DISORDERS

knowledge.offordcentre.com

This web site provides parents and educators with important information about children's mental health problems and how they may affect children's functioning at school and at home.

www.caddra.ca
Canadian ADHD Resource Alliance

This web site provides educators with important background information about ADHD. There are also links to resources describing how to support students with ADHD in the classroom.

www.chaddcanada.org
Children and Adults with Attention-Deficit Hyperactivity Disorder—Canadian web site

This web site provides information about local CHADD chapters and links to other resources.

www.teachadhd.ca
Affiliated with The Hospital for Sick Children, Toronto

This web site is for educators who wish to learn more about ADHD and ways to develop supportive classroom contexts for students with ADHD.

TECHNOLOGY AND SPECIAL EDUCATION

www.cast.org
Centre for Applied Special Technology—Universal Design for Learning

This web site describes the principles of universal design for learning (UDL). It also provides a wealth of information for educators regarding how to implement instruction that reflects UDL principles. This web site also provides links to related web sites in which one can examine UDL lessons that have been developed by other educators (UDL Lesson Builder).

http://atrc.utoronto.ca
Adaptive Technology Resource Centre of the University of Toronto

This web site provides information about adaptive technology including links to internet resources on adaptive technology and accessibility. In addition, there are a number of links providing information about various disabilities.

http://jset.unlv.edu
The Journal of Special Education Technology

This is an online publication of the Technology and Media Division of the Council for Exceptional Children.

www.setbc.org
Special Education Technology—British Columbia (SET-BC)

This web site provides a Learning Centre in which educators can learn about various types of assistive technology to support students in the classroom.

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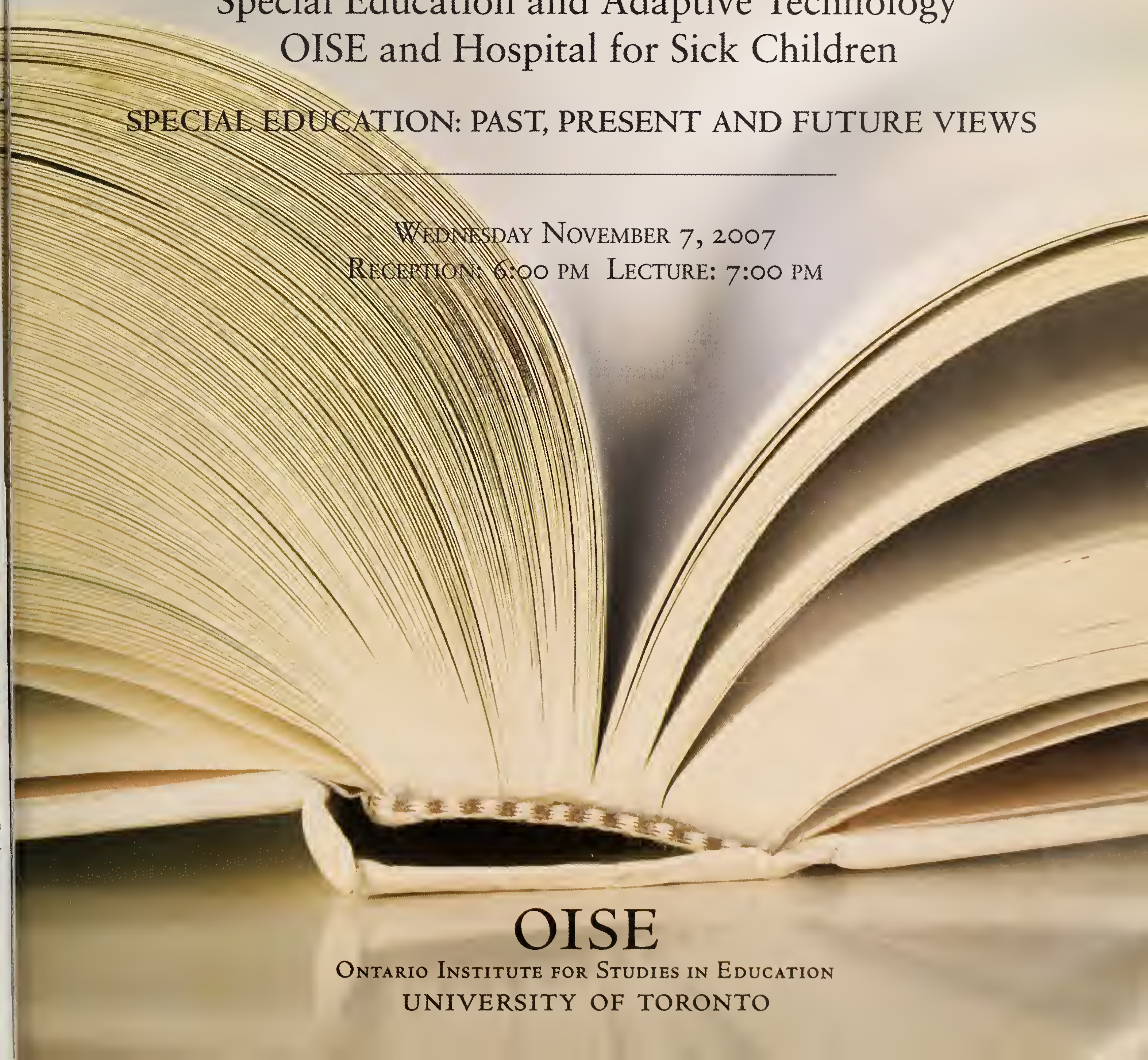
2007 JACKSON LECTURE

Speaker: Rosemary Tannock
Canada Research Chair
Special Education and Adaptive Technology
OISE and Hospital for Sick Children

SPECIAL EDUCATION: PAST, PRESENT AND FUTURE VIEWS

Wednesday November 7, 2007
Reception: 6:00 pm Lecture: 7:00 pm



OISE
Ontario Institute for Studies in Education
UNIVERSITY OF TORONTO

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OISE alumna Michelle Jenkins

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To mark the 100th anniversary celebrations, OISE created the Centennial Legacy Scholarships for both teacher education and graduate students. With our support, a new generation of students will have the opportunity to continue the tradition of excellence in education for the next 100 years and beyond. For more information on how you can make a donation visit www.100years.oise.utoronto.ca.

Professor Rosemary Tannock

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Wednesday, November 7, 2007 at 6 pm
2007 R. W. B. Jackson Lecture
SPECIAL EDUCATION: PAST, PRESENT, AND FUTURE VIEWS
Speaker, Professor Rosemary Tannock
Canada Research Chair, Special Education and Adaptive Technology, OISE and Hospital for Sick Children

Photo: Mary MacDonell

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